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Highwalker - One Bear

1979 Archaeological Excavation on the Ashland Division, Custer National Forest

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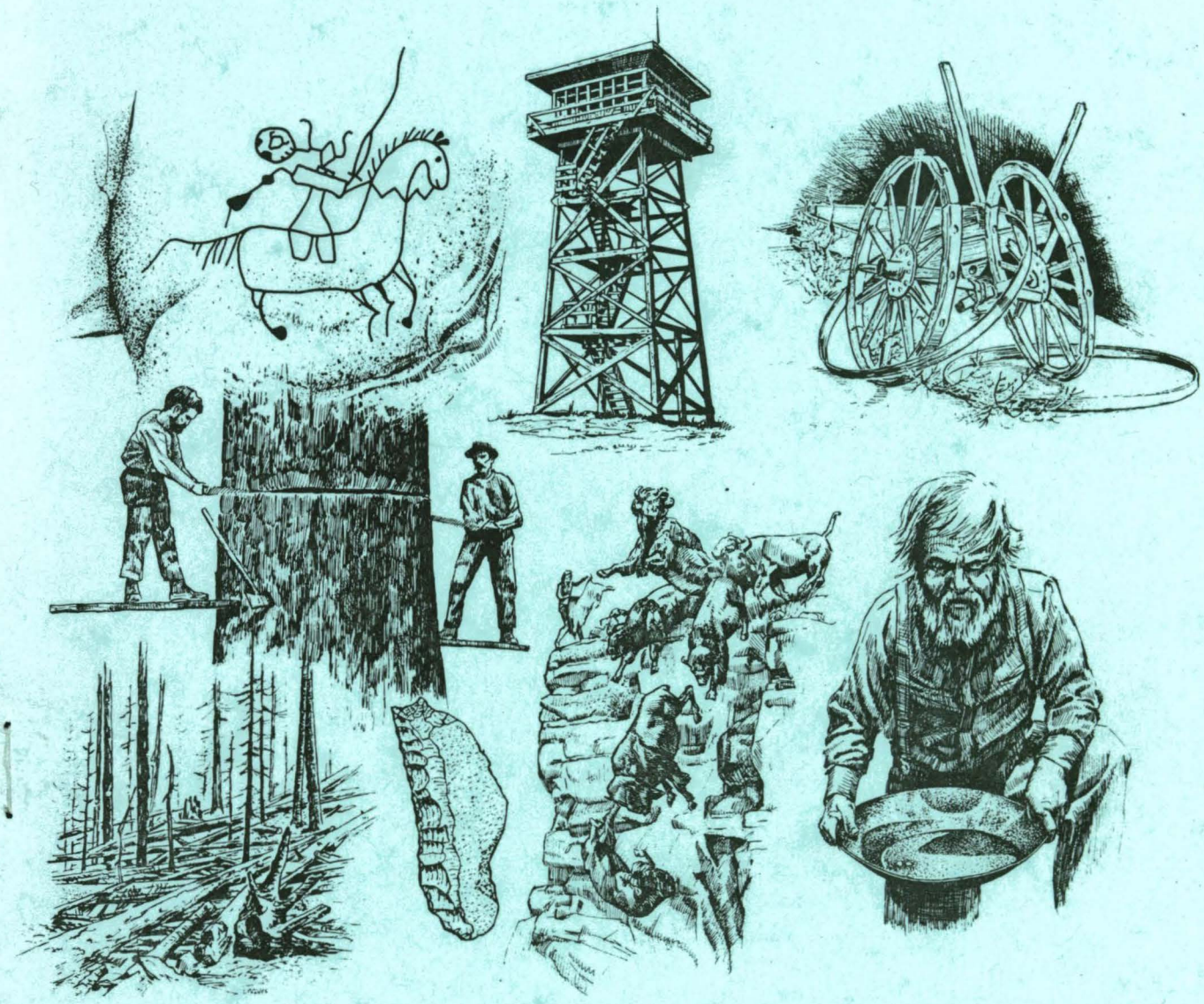

HIGHWALKER-ONE BEAR: 1979 ARCHAEOLOGICAL EXCAVATION ON THE ASHLAND DIVISION, CUSTER NATIONAL FOREST

by

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INTRODUCTION

During the summer of 1979, the U.S. Forest Service excavated two archaeological sites on the Ashland Division of Custer National Forest in southeastern Montana (Fig. 1). The sites, located in the upper reaches of Taylor and Lyon Creeks east of Fort Howes, Montana, were excavated under the provisions of a "No Adverse Effect" determination agreed to by the Forest Service and the Advisory Council on Historic Preservation (USDA 1979). The No Adverse Effect determination was based on the removal of scientific data from these sites in advance of reservoir construction planned as wildlife habitat improvement on the Ashland Division. Principal investigator for the project was James D. Keyser, archaeologist for the Northern Region Minerals Impact Evaluation Group; project director and field supervisor was Carl M. Davis, Ashland Division archaeologist. The field crew was composed of members of the Ashland Division Youth Conservation Crew (YCC), the majority from the nearby Northern Cheyenne Reservation.

The 1979 fieldwork at the Highwalker and One Bear sites was conducted during June, July, and August, as part of an ongoing cultural resource management program initiated on the Ashland Division in 1973 (Beckes 1976; McLean 1975, 1976). Construction activities in September that were scheduled to impact a portion of the One Bear site were monitored in order to recover any additional material or information that might be disturbed.

Previous Research

Although there has long been an interest in the prehistory of the Pine Parklands region of Montana, Wyoming, and South Dakota (e.g., Over

1936; Mulloy 1953, 1958), large-scale, organized archaeological investigations have only begun comparatively recently. Hence, archaeological research in the area is presently limited to a few site excavations (e.g., Mulloy 1958; Frison 1967b, 1970a; Bentzen 1962; Fredlund 1973; McLean 1976) and numerous cultural resource inventory reports funded by various federal agencies and private corporations in response to the development of coal strip mining in the region (e.g., Beckes 1976; McLean 1975; Haberman 1973; Davis 1978).

One outcome of this recent surge of archaeological investigation in southeastern Montana has been a group of regional subsistence/settlement pattern models proposed to explain the distribution of prehistoric sites across the diverse landscape of this region (Beckes 1976, 1978; Haberman 1973; Fredlund 1973; McLean 1976). Although each of these models has a somewhat different orientation, all were proposed primarily on the basis of surface-collected evidence, and all share the prevailing theme that settlement patterns characteristic of the terminal Plains Archaic period were significantly altered by the introduction of the bow and arrow, horse, and gun during the Late Prehistoric and Protohistoric periods. In this regard, many sites on the Ashland District appear to date to the Late Archaic and Late Prehistoric periods and may well contain data that will allow further refinement or modification of these proposed models.

In addition to the emphasis on developing regional settlement pattern models, archaeological research on the Northwestern Plains has focused on the delineation of the seasonal pattern of communal bison procurement (e.g., Frison 1970a, 1970b, 1973; Keyser 1979a). While this has produced a framework for the seasonal availability of bison and the

utilization of communal bison kills, much remains to be understood about the use and importance of bison and all other food resources during seasons when bison kills were not in use. In fact, until our understanding of sites other than communal kill sites is significantly increased, there is little chance of understanding the comprehensive cultural/ecological systematics on the Northwestern Plains (Frison 1973:79-80, 1978:20). In light of this concern, the sites in the region encompassing the Ashland Division may well be pivotal since large communal kills are not common, and most sites appear to represent small groups eclectically utilizing a variety of resources.

Given these factors--the two major emphases of regional archaeological research, and the known sites with potential for providing data relevant to both--we felt that data from the Highwalker and One Bear sites could contribute significantly to the understanding of regional prehistory. Hence, we designed our excavation procedures and analytical methods to provide maximum information concerning chronology, site function, and utilization.

Physiographic Setting

The Ashland District of Custer National Forest lies in the Ponderosa Pine Parklands region of southeastern Montana approximately 210 km (130 miles) east of Billings and 50 km (30 miles) west of Broadus, Montana (Fig. 1). Incorporating portions of Rosebud and Powder River Counties, the District encompasses approximately 182,000 ha (450,000 acres) of the dissected plateau between the Tongue and Powder Rivers.

Geologically the District lies within the Tongue River member of the Fort Union sedimentary formation which underlies most of southeastern Montana (Warren 1959). The Fort Union formation, deposited

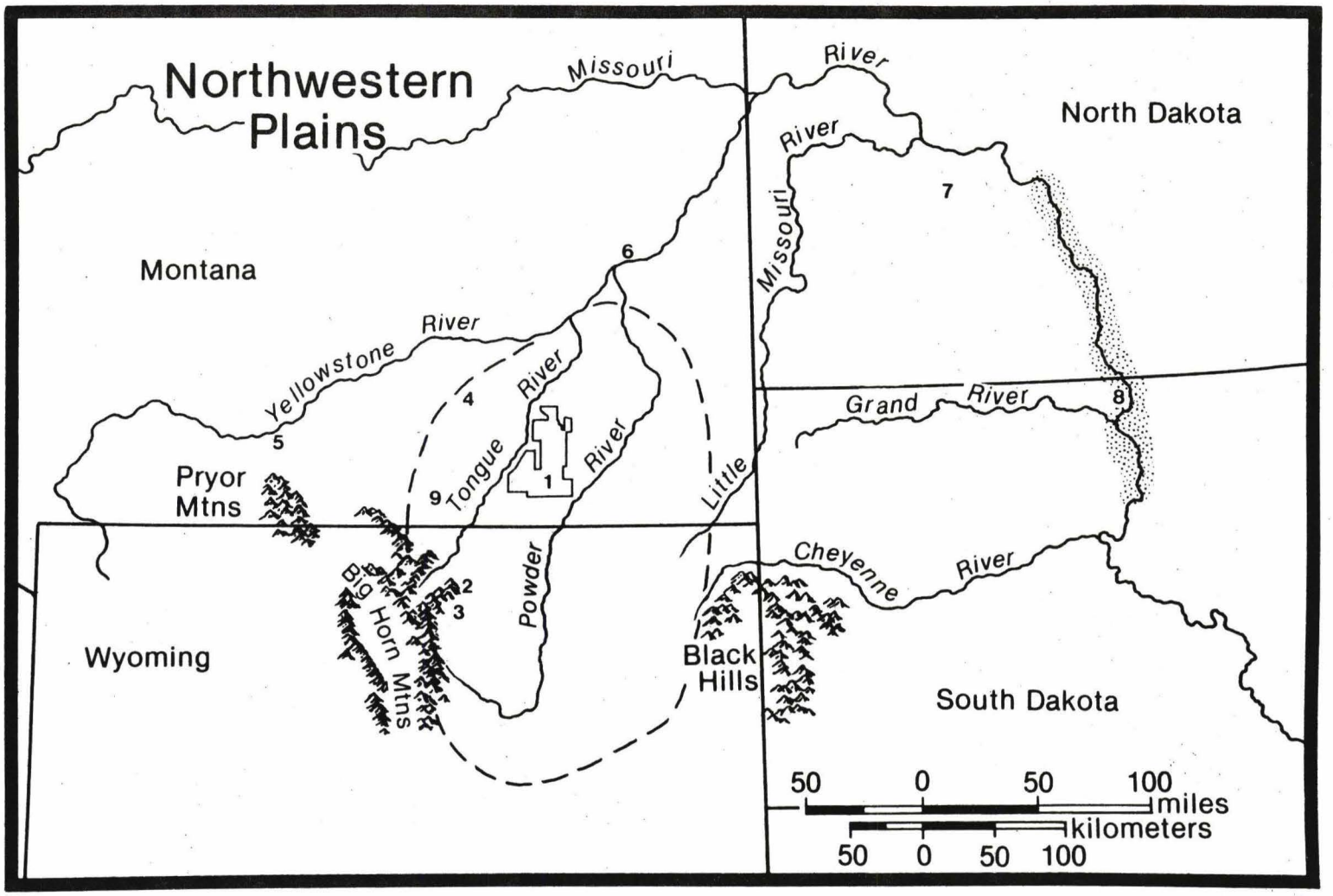

Fig. 1. Northwestern Plains. Ashland Division outlined between Tongue and Powder rivers. Dashed line indicates Powder River basin, stippling shows Extended Middle Missouri Tradition area between ca. A.D. 1050 and A.D. 1550. Numbers are: 1, Highwalker and One Bear sites; 2, Big Goose Creek site; 3, Piney Creek sites; 4, Colt 45 and Horse shelters; 5, Pictograph Cave; 6, Hagen site; 7, Knife River Flint quarries; 8, Jake White Bull village; 9, Kobold site.

during Paleocene times 60 million years ago, is composed of sediments originating in the North American cordilleran (Beckes 1976:2). Horizontally interbedded, weakly consolidated shales, sandstones, and lignite coal beds make up the formation--one of the world's largest coal basins. Spontaneous combustion of some coal seams has resulted in the formation of massive "clinker" beds that include scoria, porcellanite, and fused glass. These latter two types of stone, which occur throughout the forest both as bedrock outcrops and as nodules in derived context, were extensively used prehistorically as raw material for chipped stone tools.

Topographically the Ashland Division is a dissected plateau varying in elevation from 965 to 1465 m (2900 to 4400 feet). Water erosion of the soft, horizontally-lying sediments has formed an intricate, irregular landscape of badlands, escarpments, and scoria buttes. In the southern portion of the forest the ancient plateau surface is indicated by extensive expanses of upland shortgrass prairie. Massive sandstone cliffs, often with sizable rockshelters, many of which were occupied prehistorically, are another distinctive feature of the area.

The Ashland District lies between the Tongue and Powder Rivers and is drained by numerous small creeks and intermittent spring-fed drainages. In the area of our excavations Otter Creek is the major drainage. It flows northward from the southern Forest boundary, entering the Tongue River at Ashland. Otter Creek's many east- and west-flowing tributaries create a distinctive north/south slope topography that formed important prehistoric travel routes between the Tongue and Powder Rivers. Several of Otter Creek's tributaries (e.g., Taylor Creek, Lyon Creek) are perennial; most flow only seasonally.

These ponderosa pine parklands have a continental climate with cold winters, hot dry summers, and marked seasonal and areal variation in the amount and intensity of precipitation. Average annual precipitation is 30 to 35 cm (12-14 in.) in the lower elevations and as much as 45 cm (18 in.) at higher elevations. In summer, precipitation often comes as high intensity thunderstorms that sweep into the area from the south off the Bighorn Mountains in Wyoming. Winter snowfall averages 75 cm (30 in.) in the valleys (Thornthwaite 1941). Maximum summer temperatures range from 32 to 40 degrees C (90 to 105 degrees F), while winter lows often fall below minus 18 degrees C (0 degrees F) and are accompanied by high winds and drifting snow.

The semiarid climate of southeastern Montana has controlled the formation of its soils, which, in conjunction with landforms, produce the characteristic vegetation. In general, the area is a sparsely vegetated ponderosa pine upland interspersed with open upland prairies, sandstone/scoria escarpments, and a few lush stream valleys. It has been suggested that the ecological zonation (e.g., Creek Terraces, Dry Slope Ponderosa Pine) of the area conditioned prehistoric use--as reflected in the site distribution/settlement pattern (Beckes 1976, 1978). Our excavations were designed to provide data relevant to testing Beckes' proposed settlement pattern model.

Methodology

Excavation procedures and subsequent analyses were designed to maximize the data obtained from limited excavations at both the Highwalker and One Bear sites in order to meet the requirements of the No Adverse Effect determination under which they were excavated. In this regard, we were able to collect data concerning chronology, seasonality,

and function of the sites, and to elucidate intrasite patterning of artifacts.

Field Methods

Excavation of both sites was by 1 m square units. At One Bear these units were further subdivided into quadrants for finer horizontal control. Because cultural stratigraphy was not discernible in either site, arbitrary 10 cm levels were used for vertical control. These proved quite effective, and by rigorous use we were able to discern the "use-floor" strewn with butchered bison bone that varied from 8 to 12 cm below surface at the Highwalker site.

All matrix excavated from both sites, with the exception of flotation samples consisting of hearth contents, was wet screened in the field through 1 mm mesh hardware cloth. Flotation samples were returned to the Forest Supervisor's Office in Billings for processing. These procedures produced total recovery of the excavated artifactual material.

Recovered artifacts were sorted, labelled, and analyzed. Analytical procedures varied depending on the artifact class, but generally we were concerned with typology, method of manufacture, function, and intrasite patterning of artifact classes. A short discussion of the terminology and theoretical constructs employed in our analyses is provided to insure comparability of these data with others.

Laboratory Methods

Chipped stone artifacts are separated into two basic categories--tools and debitage. Tools are distinguished by having undergone some form of secondary modification subsequent to their fabrication into cores or spalls. Debitage (or non-tool elements) comprises those lithic elements that do not display secondary modification.

In our analysis tools were sorted and classified (e.g., scraper, projectile point) according to the form and location of the retouched edge. Although many of the terms used to define tool classes and tool types have functional connotations (which may or may not be valid), our classificatory units are based solely on morphological similarities. Functional inferences made for various tool types are derived from ancillary data such as edge angles or indications of wear. Such a classification system is consistent with recently collected ethnoarchaeological evidence indicating that edge angle is of primary importance to the users of the tool (Gould 1980:119).

Cores and primary, secondary, tertiary, and biface thinning flakes compose the debitage classes. Cores are raw material pieces from which spalls have been struck. Primary flakes are spalls with dorsal surfaces entirely covered by cortex. Secondary flakes have dorsal surfaces that show both cortex and flake scars. Tertiary flakes are spalls with no cortex and a totally flaked dorsal surface. Biface thinning flakes are those spalls which display "lipped" bulbs of percussion, acute angles at the platform-dorsal surface intersection, and multifaceted platforms.

These debitage classes represent the reduction sequence associated with a lithic technology system. That is, cores initiate the sequence and their modification results in the production of primary, secondary, tertiary, and bifacial thinning flakes. Although certain elements may occasionally be produced out of sequence, these do not significantly distort the analysis of large samples.

Similar analytical procedures were employed for the recovered ceramics. By initial examination we attempted to group the sherds into vessels; then vessel parts (e.g., rim, neck, shoulder) were identified,

and the vessel as a whole was described using standard descriptive conventions as presented by Shepard (1965), Byrne (1973:29-32), and Johnson (1977). Inferences concerning manufacturing techniques were made by comparing attributes of surface modification and paste with those defined and utilized by Shepard (1965) and Byrne (1973:30).

Analysis of the recovered bone focused on the crushed and burned debris resulting from food processing, since only three small bone tool fragments were recovered. Faunal analysis conformed to standard practices (cf. Butler 1977), with an attempt made to specifically identify any bone or fragment with a diagnostic protuberance. Bones other than easily recognizable bison elements were identified by Dr. Russell Graham, paleontologist at the Illinois State Museum.

Following identification, all bone was separated into burned and unburned categories, size graded, and weighed.

THE HIGHWALKER SITE--24PR627

The Highwalker site (Figs. 2, 3, 4) is situated on the low-lying ridge just east of and above Mud Turtle Spring. This spring flows seasonally in the fall (September-December) and spring (March-June) depending on moisture and temperature conditions, and is one source for Lyon Creek, a first-order tributary of Otter Creek which lies 14 km to the west. The site consists of three spatially separated artifact concentrations on adjacent low ridges. On the basis of similarities among the artifacts recovered from the three areas, we infer use by the same group or related groups. Prior to excavation, artifacts at the site included potsherds, bone fragments, lithic debris, and chipped stone tools exposed on small deflated surfaces and rodent mounds in all three site areas.

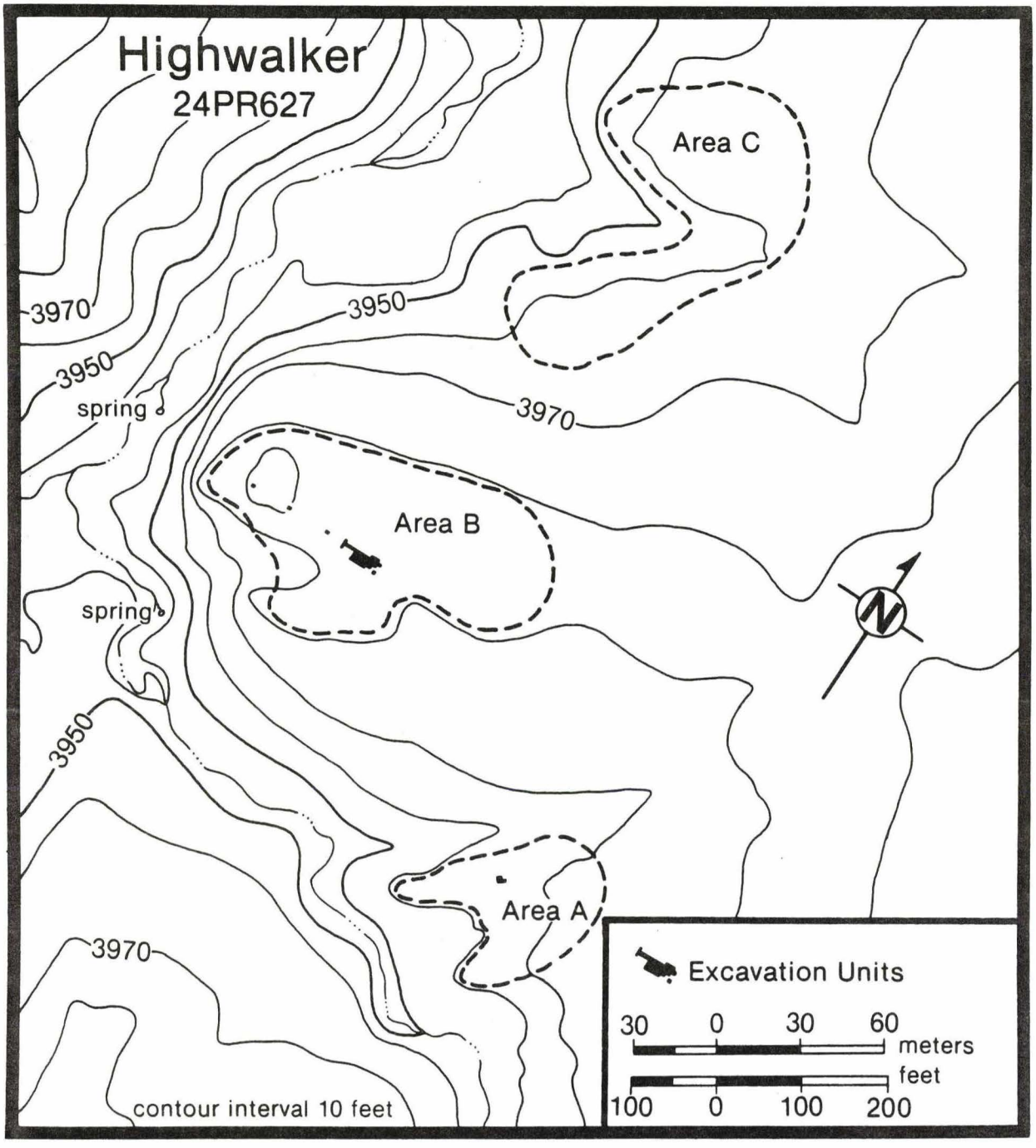

Fig. 2. Highwalker site topographic map showing site areas and excavation units.

On a larger topographic scale, the low ridge on which the Highwalker site is located lies in the bottom of an extensive, shallow basin (Fig. 3) in the open upland prairie characteristic of the area near Diamond Butte in the southeastern portion of the Ashland Division. Elevation of the site is 1205 m (3950 ft) above sea level. Scattered stands of dry slope ponderosa pine occur along the Lyon and Taylor Creek drainages to the north and west, and on the broken buttes that form the basin's southeastern rim. The site's location, at one of the most exposed, lowest-lying areas of the basin, reflects no concern for view, seclusion, protection from the elements, or easily defendable position--all of which were readily available at numerous locations around the basin rim.

Excavation

Excavation at the Highwalker site was designed to recover a representative sample of the data therein, in order to fulfill the Forest Service obligation under the No Adverse Effect Agreement. Excavation was begun in Area B by digging a series of 1 m square pits spaced along an east-west trending baseline. When an occupation level was detected, and significant amounts of cultural debris were encountered, we expanded one pit into an elongate excavation unit, roughly paddle-shaped in plan, consisting of 45 contiguous 1 m squares. Finally, a test pit was excavated just southeast of the large unit to determine the spatial extent of artifact frequencies. The major excavation is labelled Excavation Unit 1; the test pits are numbered sequentially from west to east (Fig. 2). In Area A we dug a small unit consisting of five contiguous 1 m squares, that is labelled Excavation Unit 2.

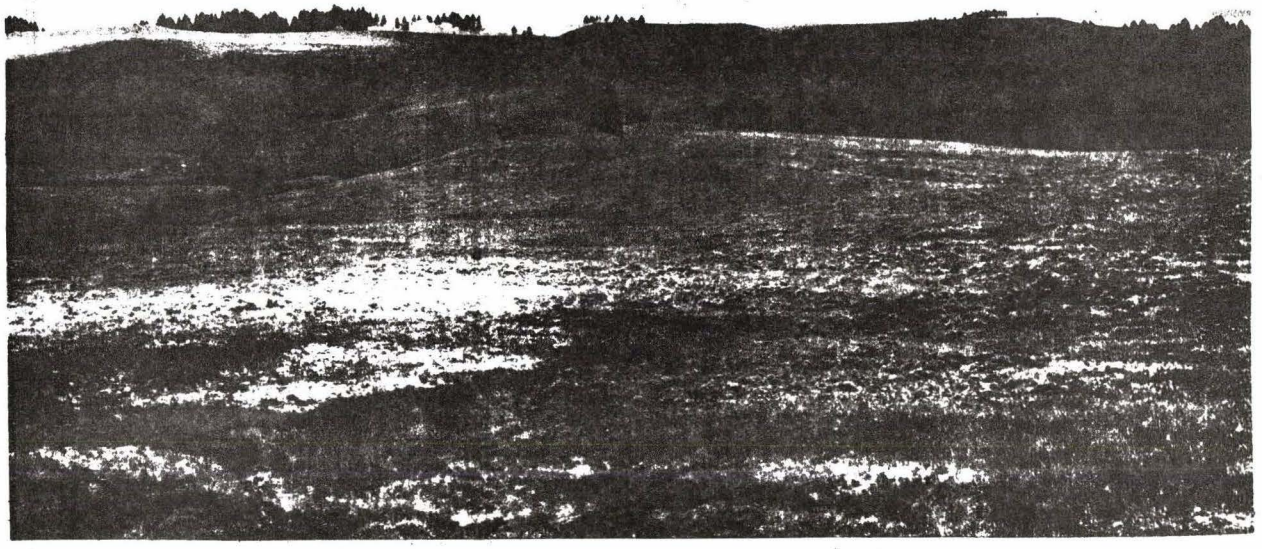

Fig. 3. Overview, looking west, of Highwalker site. Arrow indicates location of major excavation unit in Area B.

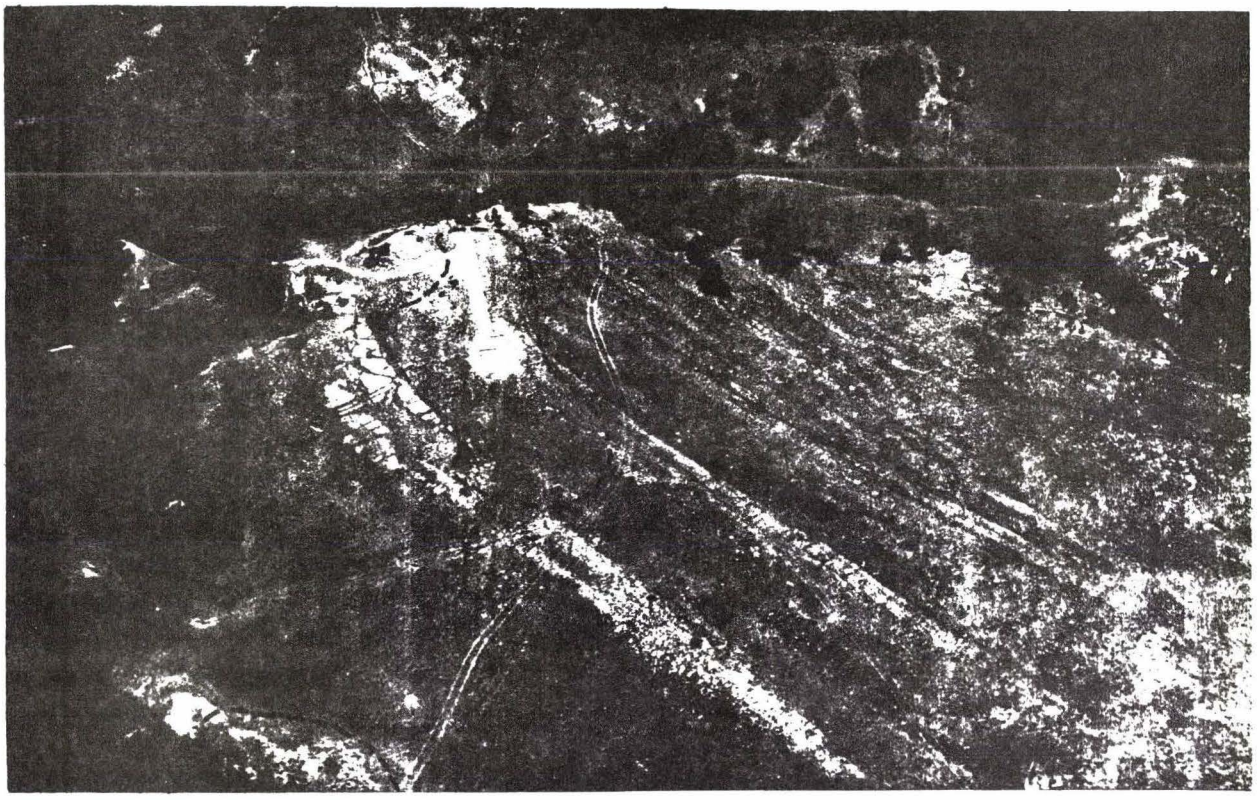

Fig. 4. Aerial view of Highwalker site during excavation. Outlines indicate site areas A, B, C from left to right.

The test pits in Area B were dug to a depth of 10 or 20 cm depending on subsurface depositional characteristics and artifact density. Excavation Unit 1 was dug to 20-23 cm where culturally sterile clay or bedrock was encountered, but in the 1 m squares composing the easternmost portion of the unit only the upper 10 cm of deposit was removed. This difference resulted from our effort to trace the horizontal extent of a scatter of butchered bison bone in the eastern part of the unit. Excavation Unit 2 was dug to 10-12 cm depth where culturally sterile white clay was encountered. All matrix was water screened through 1 mm mesh at the site, with the exception of feature fill from the hearths that was returned to the laboratory in Billings for flotation.

It is important to note here, in light of the No Adverse Effect determination, that only approximately 10 percent of the undisturbed deposits at the site were excavated. Extensive portions of the site (especially Areas B and C, but including a small portion of Area A) remain undisturbed by our excavation and subsequent construction-related activities.

The natural stratigraphy of the Highwalker site is relatively simple. In Area B, the upper 19-22 cm of the deposit was a light brown, fine-grained, loosely compacted, sandy loam--slightly darker in the upper portion that included the thin root system of the sparse surface vegetation. Rodent disturbance was readily apparent in this stratum. Approximately 20 cm below surface the matrix changed to a fine-grained, highly compact, white clay. Rodent runs skirted the surface of this deposit but rarely penetrated it, probably because of its hardness. Cultural material was recovered in primary context only from the upper sandy loam; artifacts recovered from below 22 cm were found in the fill

of rodent burrows. Friable, decomposing, platey sandstone bedrock comes to within 20 cm of the surface in one area of Excavation Unit 1, and outcrops on the slope above Mud Turtle Spring and in deflated portions of Area B.

The sequence of occupation at the site is more complex. In Area B, within the upper 22 cm of culture bearing deposit, only a single occupation floor was distinguishable. This floor, which ranged from 8 to 13 cm below surface, was marked by two firehearths (9 and 12 cm below surface) and an extensive scatter of butchered bison bone to the northeast of both hearths that ranged from 8 to 13 cm deep. From this evidence it appeared that the Highwalker site represented only a single occupation or a series of several very closely spaced occupations by the same group. However, analysis of the artifacts from the site demonstrated that there were two distinct groups of projectile points--Late Prehistoric period side-notched arrowpoints and Late Archaic period corner-notched dart points. Disregarding the corner-notched arrowpoint and McKean point that were apparently collected and reused by the Late Prehistoric period occupants of the site, the arrowheads and dart points indicate that the site was occupied twice by groups with slightly different technologies.

The nature and extent of the Archaic period occupation of the Highwalker site is not well documented by our excavations. Other than the projectile points, no artifacts were recovered or features noted that can be definitely assigned to the early use of the site. In addition, various analyses of bone, lithics, tools, and ceramics showed neither densities nor distributions that could be attributed to the Archaic period occupation. Hence, it appears that the early occupation

was a small-scale, short-term use of Area B of the site represented by an ephemeral lithic scatter that included at least three projectile points. Undoubtedly this occupation also included other chipped stone tools and debitage, and possibly bone debris, but these were apparently not diagnostic and occurred in such small quantities that they were completely masked by the later occupation of the site. A possible analog to this Archaic period occupation is site 24PR629, a sparse lithic scatter located on a low ridge approximately 400 m south of Highwalker. During initial reconnaissance of the Mud Turtle Spring area, we recovered a small sample of lithics and one small, broken, corner-notched dart point from the deflated surface of 24PR629. Since the Archaic period occupation of Highwalker was apparently a surface or shallowly buried lithic scatter when the Late Prehistoric period group camped at the site, disturbance by both humans and rodents during and subsequent to the latest use would have intermixed the two artifact assemblages to such an extent that they could not be stratigraphically distinguished.

The occurrence of a largely unrecognizable Archaic period occupation at the Highwalker site has some relevance for our analyses of the recovered artifacts. For all artifact classes (with the exception of ceramics that have not yet been found in association with Archaic period sites on the Northwestern Plains), there is the likelihood that some specimens represent the Archaic period occupation. Since projectile points are the only specimens that can be reliably attributed to separate occupations, the dart points are omitted from the analyses (e.g., tool-to-debitage ratio, tool density) so as not to bias the results. In

other instances, analysis is done as if the sample represented a single component. While this certainly introduces a small error factor into some or all analyses, the fact that there was no evidence of the early occupation in either horizontal or vertical densities or distributions, coupled with the small number of Archaic period diagnostic artifacts, indicates that the error factor is so small as to be negligible.

The physical stratigraphy of Area A is similar to although shallower than that exposed in Area B, but the nature of the occupational debris is not clearcut. During our survey we found artifacts sparsely scattered across the surface, but no concentration similar to those elsewhere on the site was noted. Excavation showed 10-12 cm of grey-brown sandy clay overlying a hard white clay similar to the basal sediment in Excavation Unit 1. Artifacts were scattered throughout the upper sandy clay with no apparent vertical or horizontal concentration. No artifact was recovered from the basal white clay. The light color and high clay content of the thin topsoil here contrast to the brown sandy loam characteristic of Area B, and suggest that it is derived in large part from the bentonite clay badlands up the gentle slope to the northeast of Area A. This implies extensive sheetwash erosion and redeposition in this area, an inference consistent with the absence of artifact concentrations. Discovery of in situ features in further excavations in this area would be necessary to determine whether the cultural debris there represents sheet erosion of a sparsely used peripheral site area, or redeposition from the extreme eastern end of Area B.

Finally, it must be noted that there was considerable rodent disturbance at the site. Rodent burrows were evident throughout the deposit in Excavation Unit 1, and in lesser numbers in Unit 2. During excavation,

however, we noted that these burrows tended to avoid site areas with the highest densities of bone and flakes, apparently because the angular, sharp-edged nature of these artifacts inhibited burrowing. Excavation demonstrated that this factor served to protect the firehearths and much of the scatter of butchered bone fragments. Because of the rodent disturbance, we elected to control horizontal provenience in terms of 1 m squares rather than the more refined quadrant system used at the One Bear site (below), and we still expected to see some horizontal "smearing" of artifact distributions. Fortunately, our density distribution analysis shows a relatively tight clustering of artifacts with only minimal diffusion apparently due to rodent disturbance.

Structural Features

Two firehearths were the only structural features encountered in the Highwalker site excavation. One is a prepared hearth located in the southeast corner of Excavation Unit 1 (Sq. L5, L6)[1]; the other is an unprepared hearth 2 m west of the first hearth, near the center of the unit in Square J4.

The larger hearth (Fig. 5) was constructed in a shallow, unlined, ovoid basin 70 cm in diameter and 12 cm deep. The basin, outlined with a thin rim of reddened, baked soil, had a dense, loosely compacted fill composed of ash, charcoal and burned bone chips. Bone chips composed more than 30 percent (by volume) of the fill. Four small potsherds and 59 tiny chert waste flakes were also included in the fill. A few of these flakes were post-use introductions into the fill by rodents, but all sherds and many flakes were discolored and/or fire crazed, indicating that they were part of the original hearth contents. The quantity of bone indicates that it was intentionally burned; the charred sherds

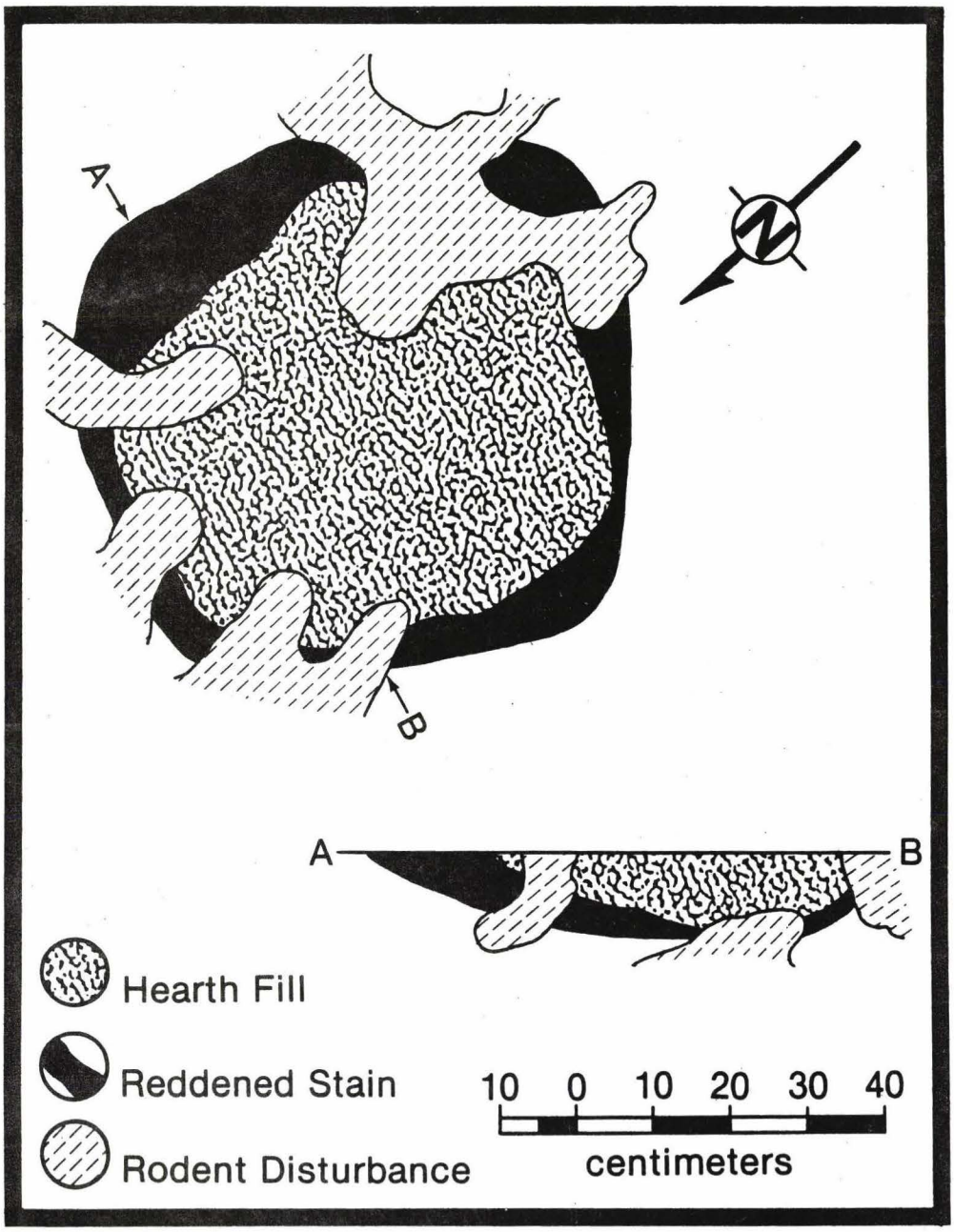

Fig. 5. Highwalker site hearth, plan map and profile.

and flakes were probably accidental inclusions. A large sample of charcoal from this hearth yielded a corrected radiocarbon date of A.D. 1043±51 (Tx-3691).

The second hearth (Fig. 6) was an amorphous, dark, smeared soil stain underlain by a thin lens of reddened, baked earth. The oval reddened stain was 60 cm in maximum diameter and a maximum of 7 cm thick. Small amounts of ash, charcoal and burned bone composed the dark stain and were scattered throughout the surrounding area. The quantity of burned bone here was much smaller than that associated with the prepared hearth. This feature represents an unconfined fire, built on an unprepared surface. Ash, charcoal and burned bone chips were apparently scattered by natural (and possibly cultural) agencies. Charcoal was recovered from this hearth, but in insufficient quantity to date.

Artifacts

Artifacts recovered from the Highwalker site include chipped stone tools, lithic debitage, ceramics, bone tools, bone debris, and gastroliths.

Chipped Stone Tools

A total of 219 chipped stone tools were recovered from the Highwalker site. On these 219 artifacts we recognized 237 discrete working edges (tool elements) because eight percent of the tools have multiple working edges with distinctly different morphologies indicating different functions. Thus, the number of tool elements recorded does not correspond to the actual number of tools recovered, but following Ahler (1977a:64) we base our analysis, classification, and tabulation on the total of 237 tool elements.

At the Highwalker site 161 tool elements were recovered from excavated matrix and 76 from the site surface. Surface collected specimens

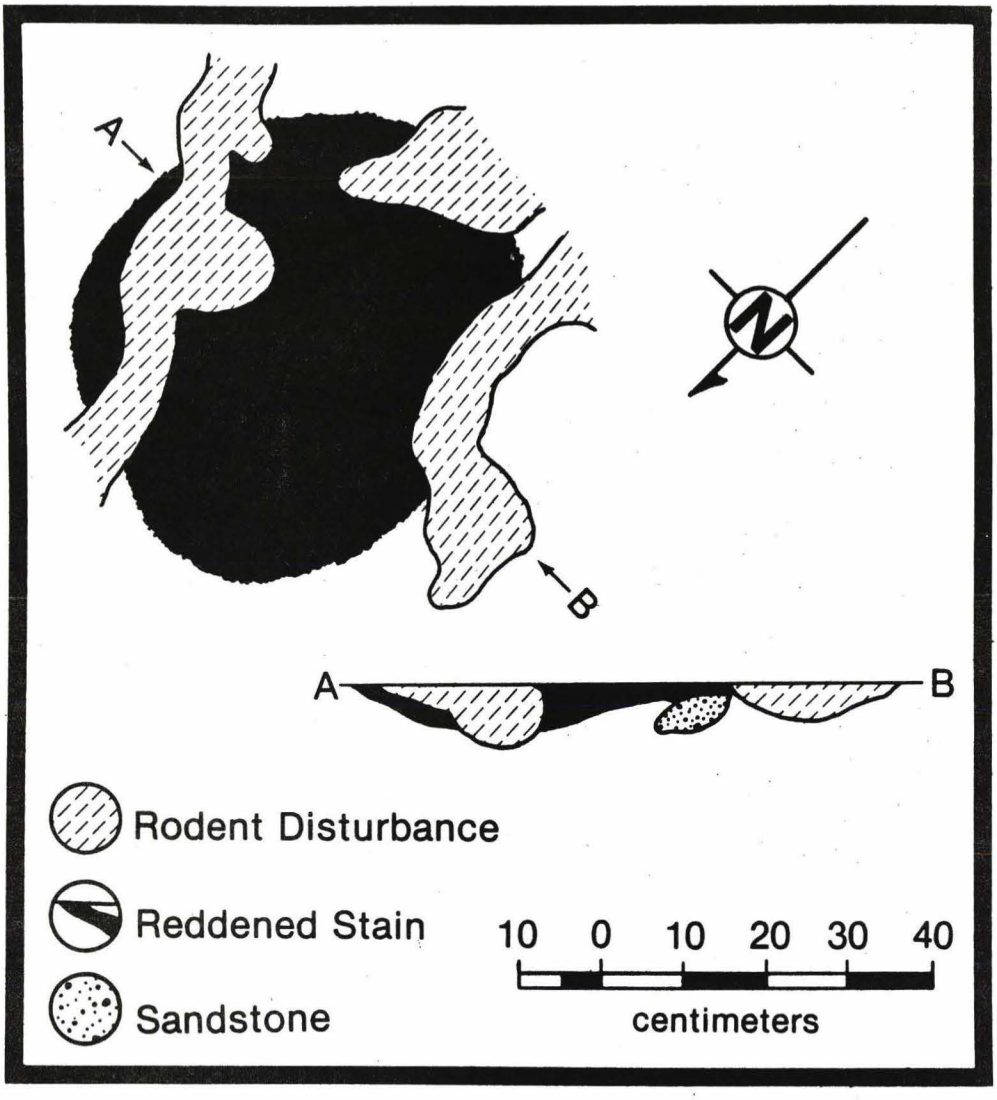

Fig. 6. Highwalker site hearth, plan map and profile.

are segregated according to the site area from which they were recovered. A total of 166 tool elements including both surface and subsurface specimens are sufficiently complete for metric analysis (e.g., size, edge angle); the remainder are too fragmentary.

The Highwalker site tool assemblage (Fig. 7) includes specimens representing 13 tool classes: projectile points, biface blades, bifaces, utilized flakes, flake geometrics, notched pieces, endscrapers, sidescrapers, perforators, drills, burins, gravers, and discoids. These are described below.

Projectile Points. Nine projectile points (Fig. 8) were recovered. Two were surface finds; the remainder were found in Excavation Unit 1. These were morphologically distinguished into four classes: small, triangular, side-notched arrowpoints (four specimens); small, bulky, corner-notched dart points (three specimens); a thin, corner-notched arrowpoint (one specimen); and a classic McKean point (one specimen). The latter two specimens are reworked into other tools.

The four broken side-notched arrowpoints were associated with the pottery-bearing component of the Highwalker site. Two were found in association with ceramics, butchered bone, and a hearth; the other two were surface finds. These points are delicate, finely-made specimens with relatively deep side notches and no basal grinding. Neck width of the two measurable specimens is 8.1 and 7.2 mm. They duplicate in form and technology arrowpoints from several other known Late Prehistoric period sites in this vicinity (McLean 1976; Beckes 1976).

The three small, bulky, corner-notched points were also found in Excavation Unit 1. Two of these are basal fragments; the other has had its broken blade shortened and reworked. Although these points were

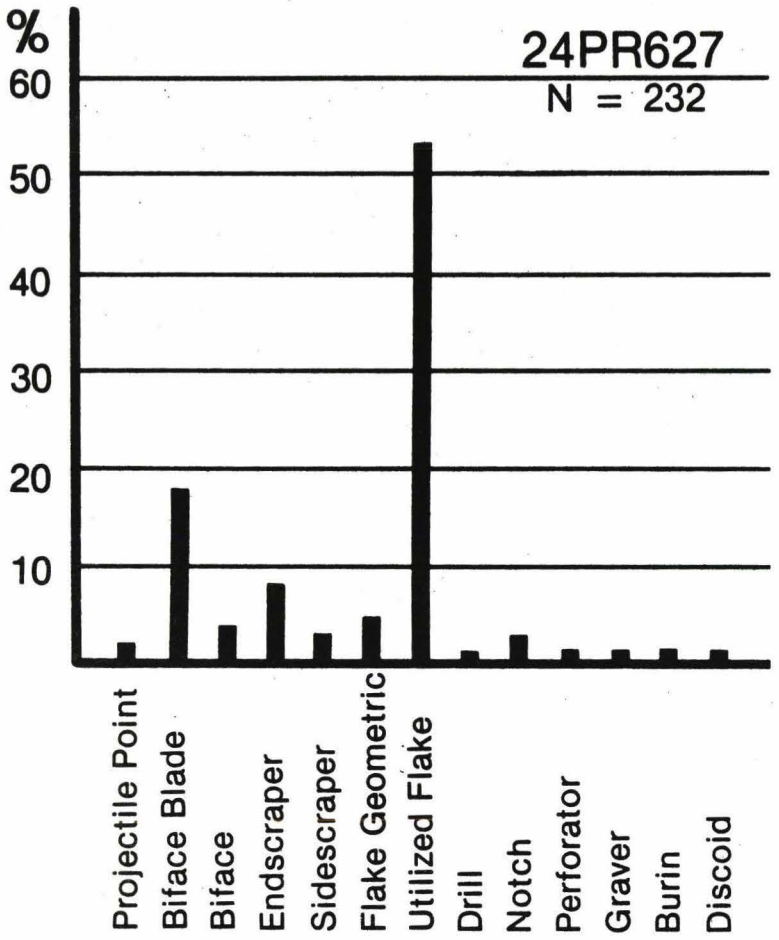

Fig. 7. Tool classes from the Highwalker site, surface and subsurface specimens combined.

found in the same stratigraphic context as the other artifacts at the site (0-20 cm below ground surface), they were all located in the west end of Excavation Unit 1, away from the main activity area of the ceramic bearing component. These points do not closely resemble any named type, but each is comparatively thick in cross section and shows basal grinding. Neck width ranges from 14 to 15 mm. These attributes are characteristic of Archaic period dart points found throughout this area.

The areally distinct occurrence of these dart points although in apparent stratigraphic association with side-notched arrowpoints and ceramics apparently indicates an ephemeral Archaic period component that was undetectable during site excavation. This is quite possible, given the lack of well-defined stratigraphy in the site deposit and the mixing caused by animal (rodent burrows) and human (firepits) agencies. Possibly the reworked dart point was used by the Late Prehistoric period occupants of the site.

Two projectile points from the Highwalker site fit neither of the above described categories, and both have been reworked into other tools. A small, thin, delicately-flaked, corner-notched point (Fig. 8f) has a burin manufactured on the snap break at its midsection. On the unbroken corner of this specimen a deep corner notch produces a distinct barb. No basal grinding is evident. Neck width is 11.7 mm, well within the range of arrowpoints in this region. The relationship of this point to the other arrowpoints at the site is not clear. Although it may have been manufactured by the makers of the other arrowpoints, its technological and morphological dissimilarities combined with its reuse as a burin suggest otherwise. Frison (1978:71) illustrates similarly shaped points that represent a little-known early Late Prehistoric period complex in

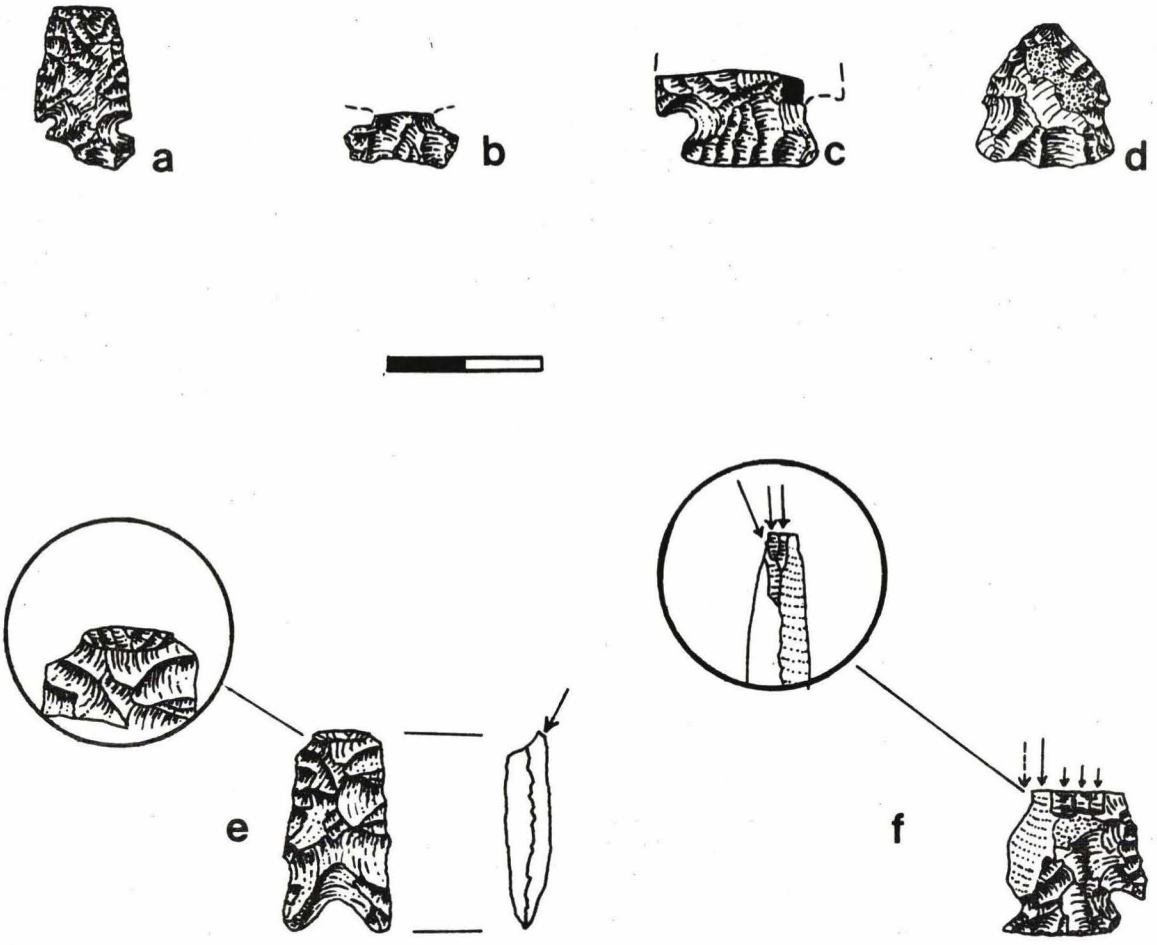

Fig. 8. Highwalker site projectile points: a,b, arrowpoints; c,d, dartpoints (d has reworked blade); e, McKean point reworked to endscraper; f, corner-notched point used as a burin. Arrows denote scraper wear on McKean point profile and burin scars on corner-notched specimen. Scale bar is 2 cm.

northern Wyoming, but the fact that this is a unique specimen at the site coupled with its reworking, suggests collection and reuse of an older point collected by one of the Late Prehistoric period occupants of the site.

A small, classic McKean point, broken at its midsection, has a minute endscraper fashioned on the lip of its snap break (Fig. 8e). This tool was found in direct association with the butchered bison bone scattered across the northeast corner of Excavation Unit 1. As with the corner-notched arrowpoint described above, the reuse of this point, its association with the Late period component, and the lack of any other evidence for a McKean phase component, suggest that it was collected and reused by the latest occupants of the site. Projectile point reuse of this nature has been demonstrated ethnographically (e.g., Weigand 1970) and archaeologically (Klippel 1969:33).

Biface Blades. A total of 42 biface blade fragments were recovered from the Highwalker site. The only unbroken specimens are those on three endscrapers (discussed below), so most are broken tips, base, and edge fragments. Because many fragments are too small for detailed analysis our description is based on the 16 largest specimens.

Biface blades (Fig. 9a) are worked over their entire dorsal and ventral surfaces and have working edges sharpened by fine pressure retouch. The largest specimens indicate that the general outline was roughly ovoid with squarish bases and pointed tips. Most specimens are relatively thin and lenticular in cross section. Workmanship is uniformly excellent.

Edge angles vary from 10° to 60° but most cluster in the upper half of this range. As Wilmsen indicates (1972:202) edges greater than 35°

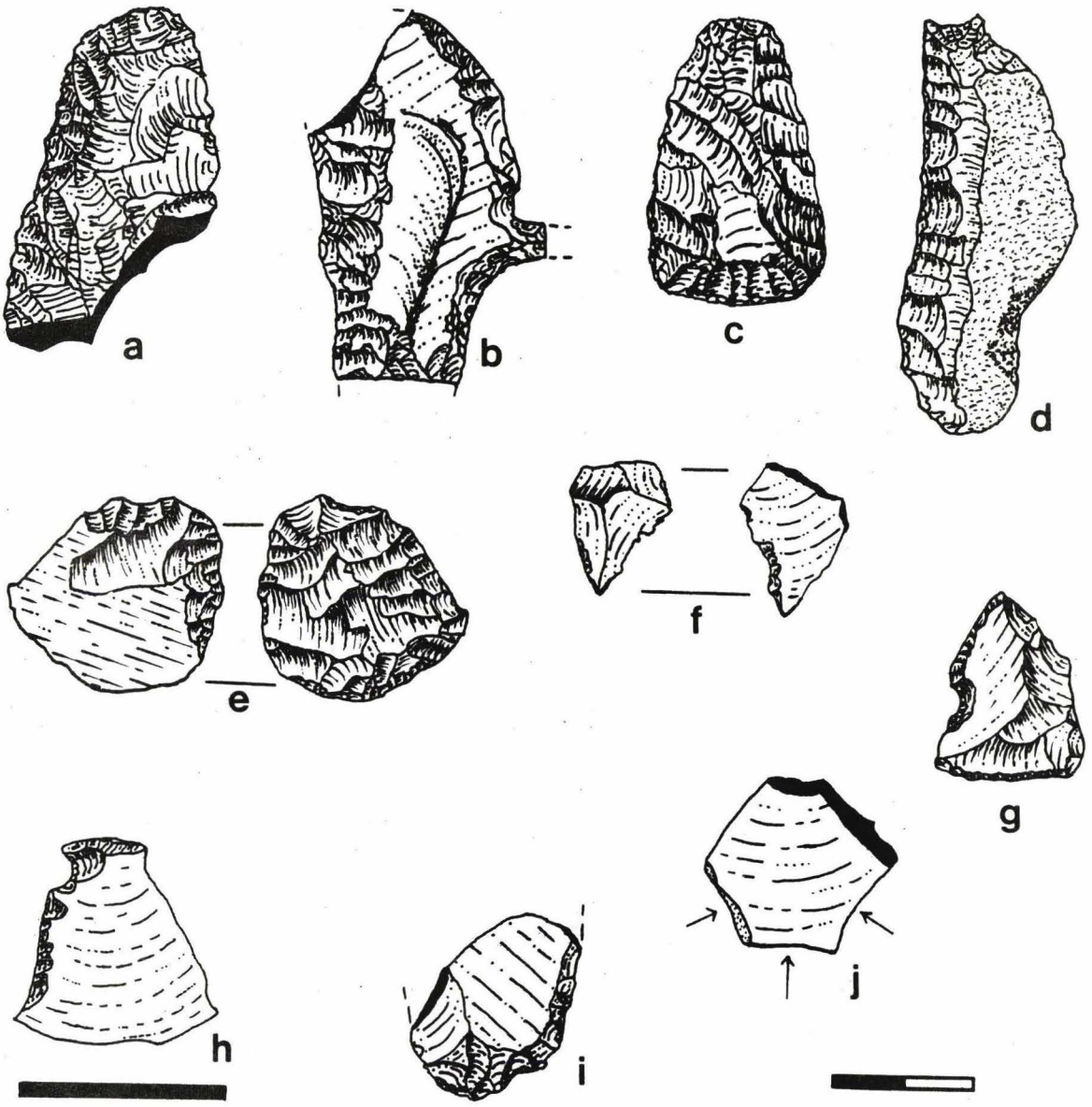

Fig. 9. Highwalker site tools: a, biface blade; b, drill with handle fashioned into biface blade; c,e, endscrapers; d, sidescraper with graver tips at top; f, perforator; g-i, utilized flakes; j, flake geometric (arrows indicate usable edges). Scale bar for h is 1 cm, scale bar for remaining specimens is 2 cm.

served for heavy cutting of a wide variety of materials, while more acutely edged tools are thought to have served in whittling and light cutting tasks. Several basal fragments show apparently intentional dulling and grinding on their base and lower margins, suggesting that they may have been hafted in bone or wooden handles like those recovered from the Late Prehistoric period deposits in Ghost Cave (Mulloy 1958:94-96).

Use wear is difficult to assess because midsections are relatively few, and most fragments show only limited attrition scarring and abrasion. The conspicuous absence of midsections implies that they were recycled into other tools while blade tips and basal ends were discarded. The pattern of snap breakage suggests heavy use--an inference which corresponds to the evidence for hafting and the predominance of relatively large edge angles.

Bifaces. Some 10 large, bulky, bifacially flaked tools showing broad shallow percussion flake scars and lacking marginal retouch are classified as bifaces. These range in form from thick ovoids to relatively thin irregularly shaped pieces. Several exhibit limited areas of remnant cortical surface on one face, but most are well made (Fig. 10a). Edge angles range from 20° to 70° but tend to cluster in the middle of this range, suggesting that they functioned primarily as heavy-duty cutting/chopping implements (Wilmsen 1972:202). Most bifaces exhibit edge abrasion, but on several specimens this appears to be edge preparation for further tool refinement. Undoubtedly some of these tools were cutting and chopping implements, but their size, shape, and edge angle coupled with the evidence of edge preparation on a few suggests that some of these may have been blanks intended for further refinement into biface blades.

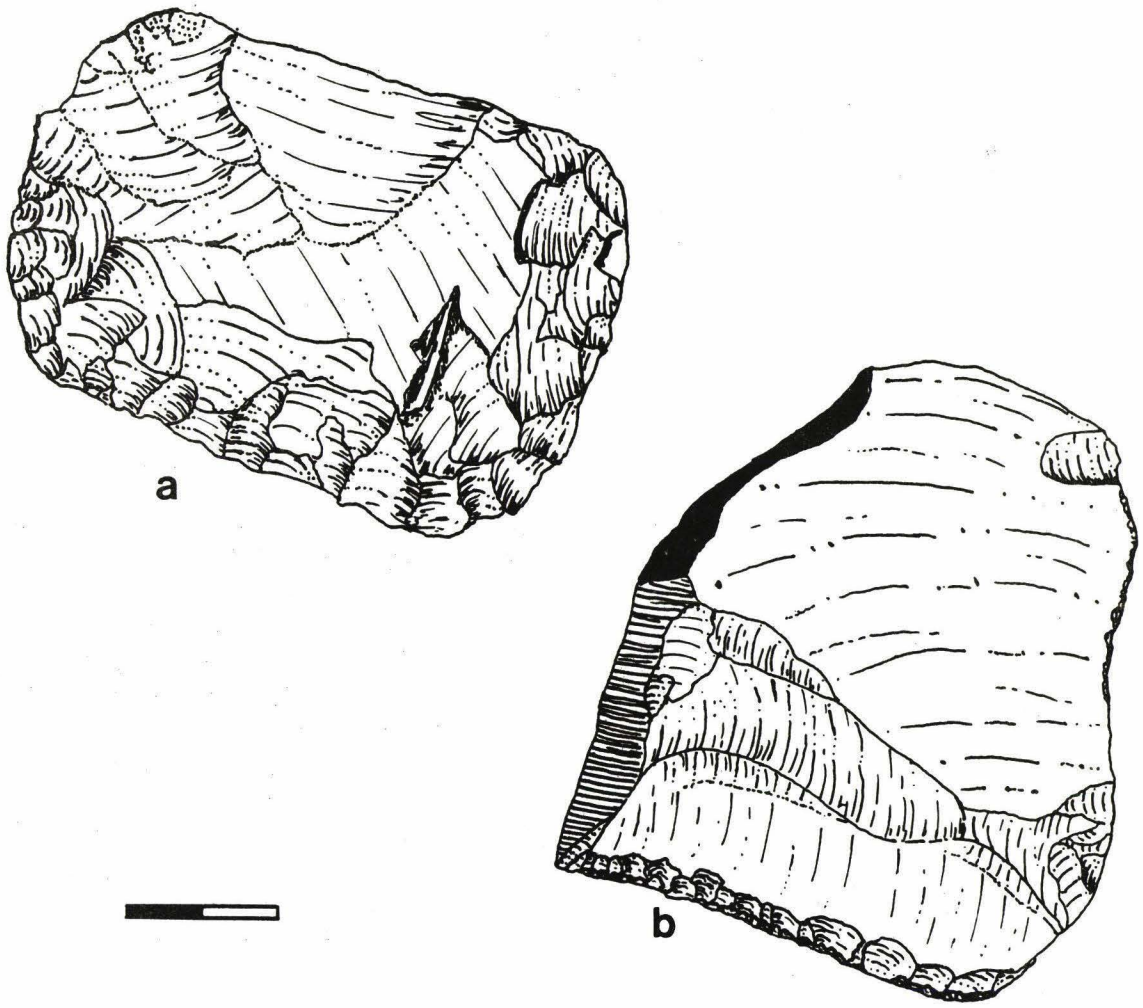

Fig. 10. Highwalker site tools: a, biface; b, sidescraper (also note utilized edge at upper right). Scale bar is 2 cm.

Utilized Flakes. Some 127 utilized flakes (Fig. 9g-i) were recovered from the Highwalker site, several in direct association with butchered bison bone in the northeast corner of Excavation Unit 1.

For two major reasons our utilized flake class subsumes specimens that show intentional edge retouch and those that exhibit only attrition use wear. First, on many flakes (particularly those of porcellanite--a relatively soft material) edge modification is so easily produced that it was impossible to accurately distinguish between unintentional use wear and intentional retouch. Secondly, during our initial analysis "retouched" flakes were distinguished from "utilized" flakes (as well as possible) but it became readily apparent that size, shape, edge angle, provenience, and inferred function overlapped so greatly between classes that this distinction was of limited interpretive value.

Given this classification scheme the following description is possible. Utilized flakes from Highwalker are predominantly made on large irregularly shaped pressure or percussion flakes. Many are large broken spalls with one or more edges that appear to have been chosen for use because of their sturdiness. Multiple working edges are common and intentionally retouched edges are comparatively rare. When it does occur, intentional retouch is usually unifacial.

Edge angles range from 10° to 70° with a slight clustering between 20° and 40°. Edge angles in this wide range indicate use for cutting and scraping activities (Wilmsen 1972:202). Several specimens have multiple working edges with distinctly different edge angles suggesting that an individual flake may have functioned in both cutting and scraping tasks. Many utilized flakes were associated with the bone scatter in Excavation Unit 1, indicating that they were extensively used in the

butchering and bone grease production activities. This inference is supported by the frequent scratches and cut marks evident on the broken bone chips from the site.

Flake Geometrics. Nine flake tools from Excavation Unit 1 are classified as Flake Geometrics. The term was coined by Rob Bonnichsen (1968) to describe previously unrecognized flake tools from a series of sites in the Plains province of Alberta, and in fact, some of the flake geometrics from the Highwalker site were initially identified by Bonnichsen (personal communication, 1979).

As described by Bonnichsen (1968), the method of manufacturing flake geometrics is relatively simple. A blow was delivered to the dorsal or ventral surface of a thick sturdy percussion flake (usually a biface thinning element) which resulted in the segmentation of the flake into geometric sections with acute to obtuse triangular shapes. These geometric segments are characterized by "snap" edges with nearly 90^{o} edge angles that form naturally sharp, tough working edges suitable for a variety of tasks (Bonnichsen 1968; Crabtree 1977).

The Highwalker site flake geometrics (Fig. 9j) have edge angles of the snap fracture that range from 75^{o} to 90^{o}. Use scarring and abrasion are minimal on most specimens, which suggests at first glance that these might be unused pieces. This is probably not the case, however, when it is noted that some experimentally produced flake geometrics used on bone and antler showed almost no abrasion or edge modification (Bonnichsen 1968:6). Four flake geometrics have edges other than the snap fracture that show retouch or attrition wear indicative of utilized flakes.

Notched Pieces. A total of eight notched pieces ("spokeshaves") were recovered from the site. Each of these specimens is made on a thin,

irregularly shaped porcellanite flake, five of which show additional use as utilized flakes. The notch on each specimen has been produced by delicate unifacial pressure retouch. These crescentic notches range from 5 to 12 mm across and 2 to 3 mm deep. All show unifacial use wear and exhibit marginal edge abrasion and rounding. Notches could have functioned as shaving implements for shaping bone or wood, for stripping sinew or meat from bones, or for shredding vegetal fibers.

Endscrapers. Eighteen endscrapers (Fig. 9c, e) including a small, broken McKean point whose snapped end was reworked into a scraper, were recovered from the Highwalker site.

With the exception of the reworked McKean point the Highwalker site specimens are typical plano-convex endscrapers, flaked only on the dorsal surface and steeply bevelled on the distal working edge. Endscrapers exhibit a variety of shapes from triangular, through rectangular, to irregular, but there is no apparent correlation between tool shape and edge angle. The rectangular and irregularly shaped endscrapers tend to be thicker and less refined, however, and generally show pressure flaking only on the bevelled end.

Several of the smaller, elongate endscrapers may have been fitted into bone or wooden handles, and in fact one specimen shows shallow notches for hafting. The triangular endscrapers are delicately flaked over their entire dorsal surface and thin markedly toward their proximal end. Presumably this shape facilitated hafting into a handle as illustrated by Wedel (1970).

Working edge angles range from 41° to 75°, a range consistent with that established by Wilmsen (1972:202) who suggests that tools with edge angles in the lower portion of this range were used to scrape hides and

other soft materials, while tools with steeper angles were used to work harder materials (wood, bone).

Working edges on four specimens are highly polished indicating intensive use on soft materials (hide, vegetal fibers); all other specimens show step fracturing and abrasion, indicative of use on harder materials.

The Highwalker site occupants showed a marked preference for manufacturing endscrapers from nonlocal lithic materials. Of the 18 endscrapers, 12 are made of chert, and all but one of the porcellanite endscrapers are crudely made specimens flaked only on the bevelled end. The preponderance of chert endscrapers and the apparent lack of care taken in manufacturing porcellanite endscrapers suggests that the cherts were preferred because of their tough working edge, retained even under heavy use. This preference for chert endscrapers is apparent in the surface collected tool assemblages from sites elsewhere on the Ashland Division (McLean 1975; Beckes 1976).

Four endscrapers deserve special mention. Three chert specimens are composite tools exhibiting finely made bifacial edges along a portion of one lateral margin. The limited use wear on these biface blade edges indicates use as light-duty cutting implements, but it cannot be determined whether this activity was associated with the scraping function or whether it represents a discrete tool use episode. As with other multiple-purpose tools, these biface blade edges are tabulated in the biface blade class. The other endscraper described here is the basal portion of a McKean projectile point with a tiny scraping edge reworked on the snap break. It was found in association with the bison bone scatter in Excavation Unit 1. The stemmed base would have been ready-made for

hafting, although this cannot be demonstrated. The point was probably carried onto the site from elsewhere since there is no evidence of a McKean component at the Highwalker site. Apparently the scraping edge was manufactured, used and discarded in the process of stripping meat from the butchered bison. Projectile point reuse such as this has been demonstrated ethnographically (Weigand 1970) and archaeologically (Klippel 1969:33; Keyser 1979a:74).

Sidescrapers. Sidescrapers were the most difficult tools to classify in the Highwalker site tool assemblage since there seemed to be a technological continuum between these tools and the utilized flakes with extensive unifacially retouched edges. Frison (1967b:15) encountered this same problem in his analysis of the Piney Creek site tool assemblage, and concluded that the distinction was arbitrary in many instances. Recognizing this, we based our classification of individual specimens on the extent of edge modification, the degree to which the dorsal surface had been worked, and the overall shape of each tool. Using these criteria we classified eight tools as sidescrapers.

The Highwalker site sidescrapers (Fig. 10b) are made on generally rectangular percussion-produced flakes and show one or more lateral edges steeply bevelled by unifacial pressure retouch. The tools are plano-convex in transverse cross section and several specimens show multiple working edges with similar bevelling. Edge angles range from 20° to nearly 80°--a slightly wider range than on endscrapers, but still indicative of a wide variety of scraping tasks. Edge wear varies from light to moderate, but every specimen shows some wear in the form of irregularly spaced attrition scars, step fracturing, abrasion, or slight rounding on the working edge. In contrast to the sidescrapers from

Piney Creek, however, no specimen shows intensive resharpening that produced the characteristic incurvate working edge (Frison 1967b:15-16). In contrast to the endscrapers from Highwalker there is no apparent preference for manufacturing sidescrapers from nonlocal raw material.

Perforators. Two perforators were found in Excavation Unit 1. The first (Fig. 9f) is a small, stout porcellanite flake, roughly triangular in outline, with a short, well-worn tip. The other is a similarly shaped point worked on the proximal end of a small chert endscraper. These perforator tips are blunt and show heavy abrasion and polish. In addition, both exhibit delicate unifacial attrition scars on the lateral margins that indicate they were used as borers twisted in a clockwise motion to drill holes in relatively hard material (wood, bone).

Drill. A single drill (Fig. 9b), manufactured on the lateral margin of a large broken, grey porcellanite biface blade, was recovered from the site surface in Area B. The gracile drill bit is 3 mm in diameter, almost diamond-shaped in cross section, and made by fine bifacial retouch. Size and shape suggest that it was a slender, delicately-made tool, probably used to work soft material.

The biface blade which served as the handle for this drill shows some marginal wear indicative of use as a light-duty cutting tool, but the edge directly opposite the broken bit is heavily ground and polished, probably to protect the user's hand when the drill bit was used. This suggests that the broken biface blade fragment may have been reworked into a drill and discarded after the drill tip broke. This reworking of a biface blade midsection supports the inferences made from the paucity of recovered midsections at the site.

Burin. A small, broken, corner-notched arrowpoint of red Phosphoria chert has a burin manufactured on one corner of the "snap" break. The burin scar shows slight wear in the form of tiny use flakes. In addition to this, use wear consisting of small tiny "step" fractures is evident all along the snap edge on one face of the point. The use wear pattern suggests that the entire snap break was used as a chisel-like tool, and the burin was manufactured to improve the working edge at one corner of the snap.

Graver. A large, well-made agate sidescraper has two graver tips manufactured on its distal end (Fig. 9d). These tiny points were made by fine unifacial pressure retouch and show limited polish suggesting moderate use.

Discoids. Three fist-sized porcellanite discoids were found on the site surface. These specimens are thick, percussion-flaked discs, roughly circular in outline, that show areas of extensive edge abrasion and dulling. Two specimens retain cortex on one or both faces. Function is uncertain. The edge abrasion may indicate platform or edge preparation for use of the discoid as a core. However, one specimen shows definite attrition scarring and edge dulling that resulted from tool use, and it is possible that the edge modification on all specimens represents use wear. Quite possibly these tools are discoid cores that were used as heavy chopping or pounding tools when they were exhausted.

Tool Analysis

Lengths and widths were measured on the unbroken chipped stone tools from the Highwalker site (Table 1). The results of this analysis show a distinct dichotomy between the sizes of patterned tools (e.g., endscrapers, biface blades) and unpatterned tools (utilized flakes).

Coupled with the limited overlap between the dimensions of tools and nontool elements (Fig. 11) this indicates that most of the utilized flakes were made from the largest debitage produced at the site, while most of the patterned tools were made elsewhere.

Tool density (Table 2) is moderately high throughout the site, but this reflects the numerous utilized flakes associated with the butchering activities that took place near the hearths in Excavation Unit 1. Density of patterned tools is very low. With respect to total tool density the Highwalker site is intermediate between other excavated transitory campsites (Keyser and Farley 1979:18, 51) and villages (Ahler 1977a:138).

Lithic Debitage

A large collection of 18,113 lithic debitage elements was recovered from the Highwalker site excavations. This total is composed primarily of tertiary flakes, with small numbers of primary, secondary, and biface thinning elements. Three discoids found on the site surface resemble cores found at workshop sites elsewhere on the Ashland Division (Beckes 1976: 55-56, 68-69), but one specimen shows limited evidence of use as a cutting/chopping tool (see Tool Analysis above). Whether these were light duty choppers whose resemblance to cores is fortuitous, or whether they were actually cores (one of which was later used as a chopper) could not be determined.

Large quantities of debitage were recovered from both the 0-10 cm and 10-20 cm levels, and debitage density (by volume of fine-screened matrix) is approximately equal in both levels. This, coupled with the fact that the hearths and bone scatter originated on a level that varied from 8 to 13 cm below surface, supports our field observation that the

TABLE 1

Metric Attributes of Tools

	N	Length $\bar{X}$	SD	Width $\bar{X}$	SD
Highwalker Site					
Unpatterned Tools	80	22.71	10.63	19.40	8.59
Patterned Tools	22	31.86	15.76	27.32	13.55
All Tools	102	24.68	12.42	21.10	10.33
One Bear Site					
Unpatterned Tools	49	29.02	11.01	20.89	7.91
Patterned Tools	23	35.82	11.26	28.13	9.47
All Tools	72	31.19	11.47	23.20	9.03

TABLE 2

Tool and Debitage Ratios and Densities

	Tool Density*	Debitage Density*	Tool to Non-Tool Ratio
Highwalker	1.77	206	1:116
One Bear	1.69	118	1:70

* Density calculated as number per 0.1 cu. m.

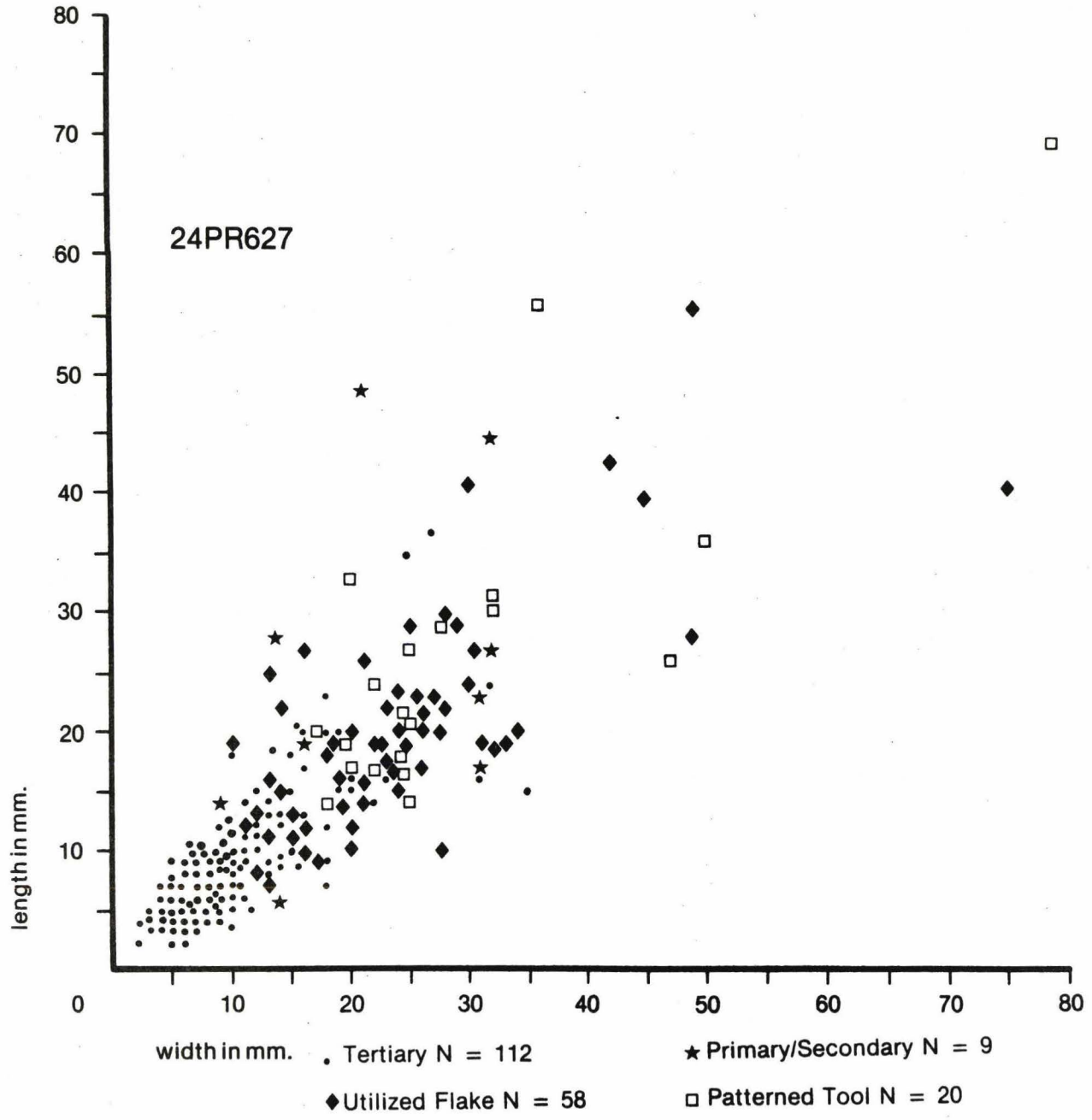

Fig. 11. Length-width scattergram of tools and debitage from the Highwalker site.

heaviest cluster of occupation debris occurred between 7 and 14 cm deep. Furthermore, it indicates that the hypothesized early occupation of the site (recognized solely on the basis of projectile point typology--see Tool Analysis above) was not of sufficient magnitude to markedly increase the debitage density in the lower level. Because the postulated early component could not be recognized in debitage density, size analysis, or raw material ratios, it was apparently of such an ephemeral nature that it was completely masked by the later occupation; hence we are forced to analyze the debitage as if it represented a single component. We recognize that the existence of a sparse, early component has the possibility of introducing some bias into the data calculations (e.g., unrecognized debitage or tools from the earlier occupation being treated as if they represented the later occupation). Therefore, we have attempted to rectify this where possible, such as by omitting the large dart points from the tool-debitage ratio. In summary, however, after careful consideration of the Highwalker artifact sample, we feel that the sparse nature of the early occupation makes it unlikely that data from it would greatly affect our analyses or interpretations.

Production Sequence

At the Highwalker site tertiary and biface thinning flakes compose more than 99 percent of the recovered debitage (Table 3). This extremely high frequency indicates that the lithic industry of the site's occupants was almost exclusively composed of final processing and maintenance of stone tools. The relatively small number of biface thinning flakes indicates that the site's occupants were not emphasizing the production and rejuvenation of bifacially worked implements, an observation that correlates well with the low frequency of biface blades and projectile

TABLE 3

Debitage Class and Raw Material Type

	Highwalker Site N=18,113	One Bear Site N=8,013
Debitage Class		
% Core	0	0.07
% Primary	0.1	0.6
% Secondary	0.7	2
% Tertiary	97	96
% Biface Thinning	2	1
Raw Material		
% Porcellanite	61	76
% Chert	26	16
% Fused Glass	2	5
% Quartzite	11	3
% Obsidian	< 1	< 1
% Other	< 1	< 1

points in the site tool assemblage. Although the presence of a few primary and secondary flakes documents some tool manufacture, the low frequency of these elements indicates that it was not a major activity. This inference is supported by the limited overlap between patterned tools (e.g., scrapers, projectile points, bifaces) and debitage which indicates that very few debitage elements were large enough to have been used as blanks.

Size Analysis

Debitage from the excavated matrix was subjected to several size analyses (Tables 4, 5) in order to provide some further insight into the lithic industry of the Highwalker site inhabitants. Initially the maximum lengths and widths of all unbroken spalls were measured, and the number of all unbroken spalls greater than 1 cm in size was recorded. Finally approximately 10 percent of the broken spalls were chosen at random and size graded through metric sieves.

Measurements of unbroken tertiary spalls (the only class for which a sufficient sample of all major lithic raw material types could be obtained) demonstrate that quartzite and fused glass flakes were smaller than porcellanite and chert flakes. Chert and porcellanite tertiary flakes average approximately the same size, however. In addition, chert and porcellanite biface thinning elements were of approximately equal average size. It should be noted, however, that the standard deviations for all porcellanite debitage categories were larger than those of the corresponding chert debitage types, indicating a greater size range overall for porcellanite debitage.

Size grading of broken spalls reemphasized this greater range of size. More than 70 percent of those broken spalls larger than 1 cm were

TABLE 4

Metric Attributes of Highwalker Site Debitage

	N	Length $\overline{X}$	SD	Width $\overline{X}$	SD
Chert					
Primary	2	21.75	13.78	30.00	21.20
Secondary	12	12.29	9.64	10.04	6.73
Tertiary	1003	5.16	2.54	4.47	2.39
Biface Thinning	73	5.95	2.20	5.13	1.76
Porcellanite					
Primary	3	10.50	4.50	12.60	6.40
Secondary	27	13.20	8.50	13.60	8.99
Tertiary	1681	5.22	3.37	4.88	3.27
Biface Thinning	133	6.05	3.65	5.36	3.51
Quartzite					
Primary	1	10.00	-	9.00	-
Tertiary	293	4.36	2.08	4.19	2.10
Biface Thinning	13	5.50	2.49	4.80	1.34
Fused Glass					
Tertiary	51	4.37	1.77	3.91	1.85
Biface Thinning	1	5.00	-	3.00	-

porcellanite. The fact that this figure is 10 percent higher than the raw material frequency for porcellanite, and the frequencies for large chert and quartzite spalls are correspondingly lower than their raw material ratios, indicates that large porcellanite flakes were produced and discarded more often than chert or quartzite flakes. Finally, size grading of the smaller broken spalls showed that more than 50 percent of chert and quartzite spalls were smaller than 3 mm while the reverse was true for porcellanite spalls.

These data, coupled with the load application analysis (below), indicate that pressure retouch was the predominant technique for manufacturing and rejuvenating tools made of all lithic raw materials. However, the size differences between porcellanite and all other raw materials suggest that chert, quartzite, and fused glass were more highly valued by the site's occupants since they produced and discarded larger flakes of porcellanite than any other material. We suggest that this reflects conservation of the less easily obtainable materials with superior edge-holding qualities (e.g., chert, fused glass, quartzite) and less concern with the plentiful, locally obtainable porcellanite.

Tool-to-Debitage Ratio

The tool-to-nontool ratio (Table 2) for the Highwalker site was calculated using the tools and debitage recovered from the excavation units (although the dart points, McKean point, and corner-notched arrowpoint were omitted since they apparently do not represent tools made by the last occupants of the site). The moderately high tool-to-debitage ratio indicates a limited range of lithic activities emphasizing tool maintenance and rejuvenation with only limited secondary tool manufacture. As is the case with the debitage density, the tool-to-debitage ratio is

most similar to that characteristic of short-term base camps in the southern plains area of northeastern Oklahoma (Keyser and Farley 1979:27-28, 61-62).

Debitage Density

Debitage density at the Highwalker site is moderately high, averaging just greater than 200 elements per .1 cu m. This figure closely compares to those derived from sites on the southern plains that served as short-term base camps (e.g., Keyser and Farley 1979:18-19, 27-30; Henry 1977a:166-178, 1977b:127-131). It strongly contrasts to the low debitage densities characterizing Southern Plains transitory camps (e.g., Henry 1977a:166-178, 1977b:127-131) and the high debitage densities of village sites (Keyser and Farley 1979:51-57). Unfortunately no Northwestern Plains sites have exactly comparable data, but analysis of debitage from the living areas (e.g., house floor and areas immediately adjacent to house) at the Jake White Bull village site in South Dakota (Ahler 1977a:135) shows a debitage density of between 120 and 200 elements per .1 cu m based on the tabulation of debitage greater than approximately 3 mm in size (Ahler 1977a:96, 101). Given that between 40 and 50 percent of the lithic debitage at Highwalker was smaller than 3 mm, an adjusted debitage density for elements greater than 3 mm would be between 100 and 120 elements per .1 cu m. This would be significantly smaller than that from the occupied areas at Jake White Bull.

Heat Treatment

Heat treatment analysis could not be undertaken on the Highwalker site debitage, since no formal criteria have been proposed by which to define heat treated specimens of most of the lithic raw material types present. However, some chert flakes exhibited a waxy luster and reddening

that suggested annealing of the raw material. Porcellanite, being of coal-burn origin, does not require heat treatment.

Load Application Analysis

Analysis of the load applications used to produce the site debitage was also undertaken, since it enables the analyst to discern the type(s) of force applied to a tool during its initial manufacture and subsequent modification, and thus provides additional data about the lithic industry of the site's occupants. Such analysis also facilitates inter- and intra-site comparisons of lithic assemblages.

As discussed elsewhere (e.g., Henry et al. 1976:57-61; Keyser and Farley 1980:256), load application analysis has recently been shown to be more accurate if quantitative attributes of debitage are used. Hence, we focused our analysis on the thickness and weight of the Highwalker site debitage in order to determine the relative occurrence of pressure and percussion flaking that was used to produce the recovered flakes.

In our analysis a randomly selected sample of tertiary flakes from the site was size-graded through nested sieves and those between 4 and 10 mm were individually measured for thickness to the nearest .5 mm and weighed. These measurements (Table 6) were then compared to the results obtained from an experiment in which spalls representing different loads were systematically separated during the manufacture of a Clovis projectile point (Henry et al. 1976). The results of this analysis (Table 6) show that the Highwalker site tertiary flakes are very similar to the experimentally produced pressure flakes. This indicates that most spalls from the site were produced by pressure flaking--a fact consistent with the overall small size of the site debitage and the limited number of spalls greater than 10 mm in maximum dimension.

TABLE 5

Size Analyses
Highwalker Site Debitage

mm	Broken Spalls Porcellanite N=1084	Chert N=506	Fused Glass N=58	Spalls Greater Than 10 mm x 10 mm N=236	
> 13	1%	1%	-	Porcellanite	71%
6-13	8%	7%	9%	Chert	20%
3-6	48%	40%	48%	Quartzite	6%
1-3	43%	53%	43%	Fused Glass	2%

TABLE 6

Load Application Analysis

	N	Thickness $\bar{X}$	SD	Weight $\bar{X}$
Highwalker Site Tertiary	116	1.10	.49	.073
One Bear Site Tertiary	110	1.61	.86	.142
Experimental Sample (From Henry et al. 1976)				
Hard Hammer Percussion	61	2.08	1.00	.090
Soft Hammer Percussion	61	1.87	.42	.084
Pressure	61	1.29	.26	.062

Raw Material Types

A wide variety of lithic raw materials was used by the occupants of the Highwalker site (Table 3). For analytical purposes, we have separated the large lithic sample into six major classes: porcellanite, fused glass, chert, quartzite, obsidian, and other. While each of these categories is morphologically distinct, they all show a broad spectrum of intraclass variation in color, texture and other attributes that have been used by some authors to distinguish varieties and suggest source areas (e.g., Knife River flint, Phosphoria chert, Pryor Mountains quartzite). Our analysis, however, shows that the supposedly characteristic attributes of these varieties blend one into another (e.g., agate to Knife River flint to petrified wood), making the valid identification of small flakes extremely difficult, if not impossible. In addition, many lithic varieties and their source areas cannot be positively identified without extensive geochemical and petrographic analysis (Clayton et al. 1970:287-289). Hence, we have made no attempt to subdivide these broad categories described below.

Porcellanite. Porcellanite is a distinctive lithic material of coal burn origin, localized on the Northwestern Plains area of Montana, Wyoming, and North Dakota (Fredlund 1976). The stone, also referred to as metamorphosed shale, fired brick, and other terms, is found as part of the Fort Union formation--a series of interbedded sandstones, shales, and lignite coal seams. It has been formed over the last million years by contact metamorphism with naturally burning coal beds and is abundant throughout the area, often occurring as massive deposits capping buttes and ridges. Porcellanite from the site includes nearly the total spectrum of colors characteristic of the material, ranging from black through

purple, red, yellow, and grey. Purple, red, and grey are the most common; yellow and black occur only rarely. Porcellanite works easily and was used for a wide variety of tools, despite the fact that it does not hold an edge as well as the cherts used at the site.

Fused Glass. Fused glass, called nonvolcanic obsidian and vitreous porcellanite by some authors, is also a product of natural combustion of the Fort Union lignite beds. Unlike porcellanite, however, it is a glassy "slag" formed along or extruded from vents or fissures leading from the surface to the burning coal beds (Fredlund 1976:209). Because it requires extreme heat and venting, it is not as abundant as porcellanite and occurs as localized deposits. It is easily recognized and distinguished from obsidian by the microscopic bubbles and vesicular texture. Colors noted in the Highwalker site collection include red, green, grey, and black in order of abundance. Fused glass is brittle and works easily to produce a sharp but easily crushed edge, much like obsidian.

Chert. Chert, as used here, comprises a wide variety of cryptocrystalline silicates including what is elsewhere called agate, flint, argillite, jasper, chert, and petrified wood. As a group, these materials exhibit a continuum of color, texture, and opacity that precludes valid identification of subtypes (e.g., Knife River flint vs. petrified wood) in many instances. However, in the sample of more than 4,500 chert flakes, many individual specimens were noted that visually resemble Knife River flint, petrified wood from the badlands of eastern Montana and the western Dakota, Yellowstone agate, and varicolored cherts from the Phosphoria and Madison formations exposed in the Bighorn Mountains of Wyoming. Undoubtedly, some of these materials came from these widespread

source areas. Color, texture, and other attributes of the Highwalker site cherts show such a broad spectrum of variation that verbal description is meaningless. These chert varieties were definitely an important part of the occupants' lithic industry and were used predominantly for fine cutting and scraping tools, probably because they hold a sharp edge even after repeated use.

Quartzite. Quartzite from the Highwalker site includes a limited variety of grainy stone ranging in color from white or grey, through yellow and brown, to purple. Texture varies somewhat from fine- to coarse-grained, but all quartzites were easily distinguished from the other lithic materials on the basis of their graininess. Many quartzite flakes were visually similar to the various quartzites found in the Bighorn and Pryor Mountains, and, undoubtedly, some specimens came from quarries there. At the Highwalker site, quartzite tends to be used for relatively large-scale cutting, scraping, and chopping implements, apparently because it is easily worked to a tough, elastic edge that stands up well to heavy utilization (Toll 1978).

Obsidian. Obsidian was found in limited quantities at the Highwalker site. The small flakes are opaque and highly lustrous, similar to the obsidian from the Yellowstone-Teton Park area of Wyoming, but this identification cannot be verified in the absence of trace element analysis. No obsidian tools were recovered.

Other. Six specimens do not fit within any of the raw material categories. These include two tools and one flake of coarse-grained black stone that resembles the basalt used commonly for tools in the Northern Rocky Mountains and Columbia Plateau regions. Three tertiary flakes of a grainy grey silicious stone resemble the finer grained varieties of

Tongue River Silicified Sediment found in western North and South Dakota (Ahler 1977b:135-137).

Discussion

Although there were differences in the percentages of lithic material types recovered from the two excavated areas of the Highwalker site, the ratios are not significantly different and can be explained by sampling error, slight differences in the function of each area, raw material preference of individual occupants, or a combination of these. Hence, raw material utilization is summarized for the recovered lithic sample as a whole.

Porcellanite was by far the most commonly used lithic material at the Highwalker site, making up more than 60 percent of the recovered debitage (Table 3). Chert and quartzite were also abundant, however, and accounted for a combined total of more than 35 percent. Fused glass, obsidian, basalt, and Tongue River Silicified Sediment were present in negligible quantities, totaling only 2 percent of the recovered lithic sample. Examination of these frequencies leads to some interesting conclusions about the lithic industry of the site occupants. Although porcellanite was the material most commonly used, it was far less common than at other sites in the region (Fredlund 1976; Fredlund and Fredlund 1974:31; see also One Bear site, below). This probably reflects, in part, the fact that the group using the Highwalker site had wide-ranging contacts, as evidenced by the regional distribution of their characteristic pottery, and the lithic raw material they obtained from as far away as western North Dakota and north-central Wyoming. We feel, however, that it probably also reflects the value of the superior quality, less easily obtainable, lithic materials such as chert, quartzite, and obsidian.

Their value would require conservation by the site's occupants. This would mean that these raw materials would be brought to the site in the form of tools or preforms, and only tiny pressure flakes would be produced in the final stages of manufacture and maintenance of these tools. When the group moved camp, these tools would be removed so that the only remaining items of these raw material types would be small-size debitage and tools that had been lost or broken into fragments too small for rejuvenation. Obsidian, represented at Highwalker by only a few small pressure-produced tertiary flakes, illustrates this behavioral system very well, but it is interesting to note that the size range of fused glass flakes and the scarcity of recovered fused glass tools suggests that it, too, may have been a preferred, curated raw material, rather than one that was avoided, as has been suggested (Fredlund and Fredlund 1974:102; Fredlund 1976:210). Given the possibility of extensive lithic conservation/retention skewing the frequency of non-porcellanite raw materials in the tool and large debitage samples, caution should be exercised in making assertions as to the preference for raw materials from surface collections of large-size debitage (e.g., Fredlund and Fredlund 1974:31; Fredlund 1976). Although raw material frequencies can provide much information relevant to a group's lithic industry and interaction sphere, we suggest that these frequencies are neither meaningful nor useful for intersite comparisons unless debitage and tool samples collected for analysis reflect the total size range at a particular site.

Analysis of the primary and secondary elements from the site provides some information about the lithic procurement activities of the Highwalker site occupants. All porcellanite cortical elements (more than 100) show bedrock cortex, indicating that porcellanite was quarried

from the numerous outcrops in the area, rather than obtained from gravel deposits. This probably reflects a combination of factors, including the relative ease of obtaining porcellanite from surface sources, the abundance of sources in the area, and the fact that porcellanite has no qualities that would make scavenging it from river gravels worth the effort. Cortical surfaces of the few recovered secondary flakes of fused glass were difficult to identify as either bedrock or gravel cortex. This may be because fused glass is formed as nodules (Fredlund 1976:209), rather than true bedrock, causing most, if not all, examples to occur in a derived context. It is possible, however, that some of the material was obtained from gravel deposits. Chert and quartzite flakes (fewer than 50) showed both bedrock and gravel cortex in approximately equal proportions, indicating that these materials were collected from bedrock quarries, riverine gravel bars and terraces, and possibly glacial tills. These data suggest that the superior knapping qualities of these materials, and their property of holding a good edge, made it worth the effort to trade for them, to travel long distances to source areas, or to scavenge gravel deposits. No obsidian cortex flakes were found.

Ceramics

Some 552 potsherds were recovered from the Highwalker site, both from the surface and from the excavation units in Areas A and B. The sample includes 528 body sherds and 24 rim sherds. More than 90 percent of the sherds were clustered around the firehearth in the southeast portion of Excavation Unit 1 in Area B. The sherds range in size from 6 to 45 mm in maximum dimension but the majority are between 10 and 30 mm in size. A few sherds could be reassembled but the largest reconstructions consist of fewer than 10 sherds and are smaller than 6 cm in

maximum dimension. In addition to the sherds, a small quantity of "crumbs" less than 6 mm in size was recovered from the same area. Although these appear to duplicate the sherds in all recognizable characteristics they were too small for detailed study, hence they are not included in the analysis or sherd count.

Size Analysis

Size grading of the Highwalker site ceramics was attempted in order to understand the intensity of use and duration of occupation of the Highwalker site (Table 7). This analysis shows that 71 percent of the sherds are smaller than 13 mm in maximum dimension and that no sherd exceeds 5 cm in size. When compared to data from the Jake White Bull site--an Extended Middle Missouri village in South Dakota--these figures are most similar to those from subfloor pit and ditch contexts and contrast to those from house floor locations (Ahler 1977a:48-49). Reflecting Ahler's (1977a:48) hypotheses, our data suggest that the broken pottery at Highwalker was exposed to foot trampling for a relatively short period.

TABLE 7

Ceramic Sherd Size-Grade Analysis

Size	Area A		Area B		Area C		Total	
	N	%	N	%	N	%	N	%
> 51 mm	0	-	0	-	0	-	0	-
26-50 mm	0	-	19	3.7	3	8.3	22	4
14-25 mm	2	25	181	35.6	7	19.4	138	25
6-13 mm	6	75	308	60.6	26	72.2	392	71
Total	8	100	508	100	36	100	552	100

Description

Ceramics were recovered from each of the three areas of the Highwalker site. These sherds represent at least six vessels of the same pottery tradition. They are listed by area and described below.

Area B

Some 507 potsherds representing three vessels were recovered from Excavation Unit 1 in Area B. In addition, a single large sherd that probably was part of one of these vessels was found on the surface near the excavation unit. The three vessels were identified on the basis of distinctive rim and lip form. Body sherds showed a number of surface textures and treatments, but poor sherd preservation, small size, and discoloration caused by unintentional burning and soil staining usually precluded the possibility of positively determining which sherds composed a specific vessel. Hence, the entire body sherd sample is treated as a unit.

Vessel 1. This vessel is a necked jar with a poorly defined shoulder and probably a globular body. The rim (Fig. 12) is vaguely "S" shaped in profile with a smoothed, flattened, undecorated lip. Rim sherds are between 5 and 8 mm thick, with maximum thickness occurring at the neck. The lip slopes slightly outward, has rounded edges, and measures between 5 and 7 mm wide. Extrapolation from the arc of a reassembled rim sherd suggests an orifice diameter between 19 and 22 cm.

The distinct neck begins between 3.3 and 3.8 cm below the lip. Between the neck and lip is stamped a pattern of vertically oriented grooved paddle marks. The grooved paddle impressions are 3 to 3.5 mm wide, 0.5 mm deep, and spaced between 4 and 7 mm apart. The careful placement of the indentations suggests intentional paddling for decorative purposes.

Vessel paste is fine grained, compact, and well bonded. Hardness is 3 to 3.5 on Moh's scale. Moderate amounts of crushed granite particles between 1 and 4 mm in size were used as temper. Color is reasonably uniform throughout each sherd and ranges from black to light greyish tan. The interior surface shows evidence of being smoothed with a yielding tool while plastic (all surface treatment techniques were determined by using a 10 power hand lens and referring to the characteristic textures illustrated and described by Shepard [1965: Fig. 13]). In places the interior surface is badly spalled, probably the result of firing the vessel before it was properly dry. The exterior surface shows a slight luster along the edges of the lip and on the smoothed ridges between paddle impressions. This indicates that the vessel was lightly polished with a hard tool after the clay had dried. A few shallow striations and small pits predominantly in the neck region indicate that this area was lightly scraped when almost dry.

A few body sherds that appear to be parts of Vessel 1, on the basis of surface treatment and coloration, have a very thin carbon encrustation adhering to their inner surface. This probably represents burned food residue.

Vessel 2. A group of eight small rim sherds represents a vessel similar to Vessel 1, but with a distinctive lip decoration. Rim sherds are thinner than Vessel 1, measuring 4 to 6 mm thick. Vessel shape is indeterminate, but a few thin body sherds that almost certainly are part of this vessel show a distinct neck. The rim (Fig. 12) is nearly straight. The lip is 4 to 6 mm wide. Overall shape of the lip is rounded, but slightly flattened on top. It is decorated with a pattern of sharp notches impressed diagonally across it at a uniform angle of 40°. The

notches are spaced 6 to 7 mm apart and are 2 mm wide and 1.5 mm deep. They were apparently impressed with the sharpened edge of a bone or wooden tool. The lip was smoothed slightly after the notches were formed.

Paste is fine grained, very compact, and well bonded. Hardness is between 3 and 3.5 on Moh's scale. Paste is sparsely tempered with small sand grains less than 1 mm in size and occasional larger crushed granite particles up to 3 mm in size. Color is black throughout, but some sherds are light greyish tan, probably the result of soil discoloration. Both the interior and exterior surfaces show plastic flow, indicating that they were wiped with a yielding tool while the clay was moist. Both surfaces are also moderately lustrous, indicating that the dry vessel surfaces were finished by polishing with a hard tool.

Vessel 3. Thirteen small sherds compose part of the rim and neck of a third vessel. Five sherds could be reassembled to show the neck constriction with part of an incised line decoration.

Vessel 3 has a constricted neck with an outflaring rim (Fig. 12). No shoulder is evident, but few body sherds could be positively identified as parts of this pot. The rim flares slightly, and the arc of the reassembled portion suggests an orifice diameter between 12 and 16 cm. Rim sherds are 3.5 to 5 mm thick.

The sloppy, slightly thickened lip slopes outward and is decorated by a series of small irregularly shaped ovals oriented parallel to the lip's long axis. The ovals vary from 6 to 8 mm long, 2 to 3.5 mm wide, and are a maximum of 1.5 mm deep. Their shape suggests that they were made by pressing the tip of a blunt bone or wooden awl into the soft clay with the size variation resulting from pressing the instrument to different depths.

In several instances the depressions have destroyed or modified the outer lip edge. In no case is the inner edge damaged. Plastic flow along the sides of several impressions indicates that the lip was smoothed with a yielding tool (probably the fingers) after the decoration was made. General lip shape is rounded with a slightly flattened, outsloping crest--much like that of the lip of Vessel 2. The lip varies from 4 to 5 mm wide.

An incised line design (Fig. 13) begins 1.5 cm below the lip on the reassembled rim portion, and on another single rim sherd. Other sherds that could not be reassembled have incised parallel lines that represent part of this design or a similar one. The incomplete portion of the reassembled design is of sufficient complexity to defy detailed verbal description, but basically it consists of at least five parallel, diagonally oriented lines interrupted by an inverted V (or the apex of a triangle?) and several apparently random nicks and gouges. On the single rim sherd the parallel lines are horizontally oriented parallel to the crest of the lip. The design was carelessly made and the incisions vary from scratches to cuts just less than 1 mm deep and just more than 1 mm wide. All incisions are V-shaped with slightly burred edges indicating that they were cut with a sharp pointed tool when the vessel paste was moist and plastic (Shepard 1965:198). The sharply squared ends of the nicks and gouges indicate that the instrument had a "squarish," probably naturally sharpened point. These characteristics suggest that an unmodified bone splinter was used as the incising tool. Plastic flow into some incisions indicates that part of the vessel's neck was lightly smoothed with a yielding tool after decoration.

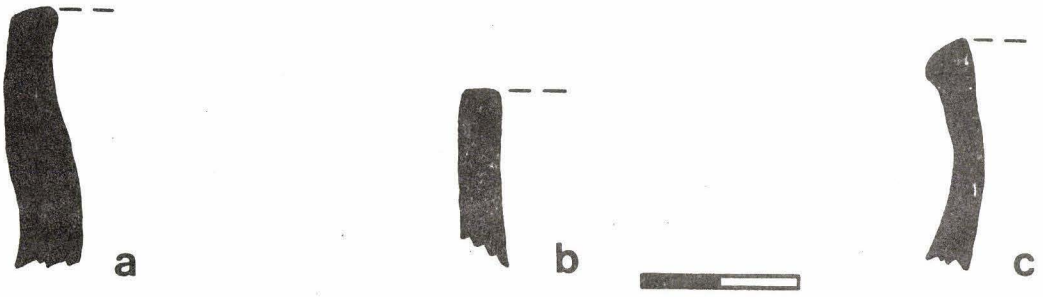

Fig. 12. Highwalker site rimsherd profiles: a, vessel 1; b, vessel 2; c, vessel 3. Interiors of vessels to right. Scale bar is 2 cm.

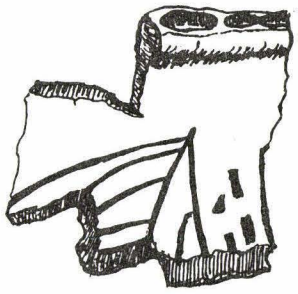

Fig. 13. Incised line decoration on portion of rim of vessel 3. Also note tool impressed lip decorations.

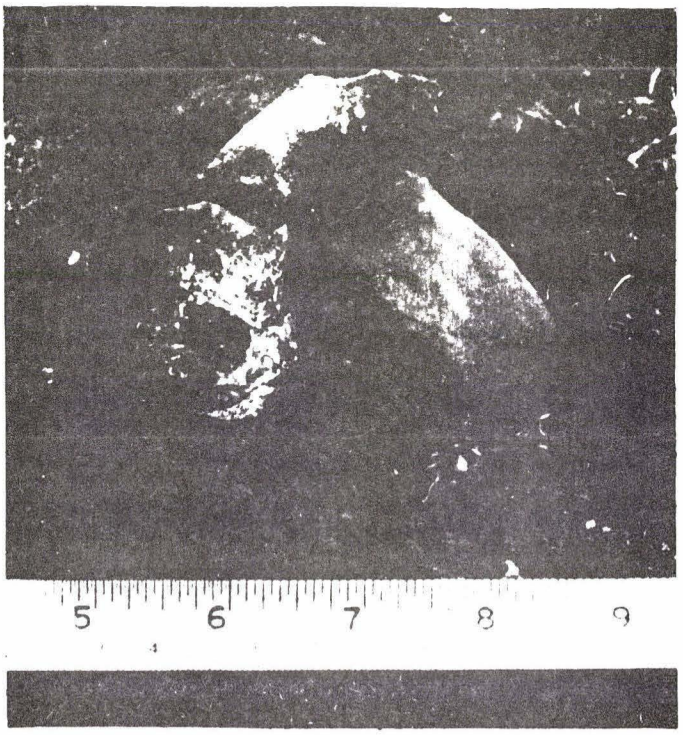

Fig. 14. Utilized flake in situ near articulated bison phalanges.

Vessel paste is compact, fine grained, and well bonded. Interior sherd color is black. Hardness is 3.5 to 4. The sparse temper consists solely of fine sand grains less than 1 mm in size. Exterior and interior vessel surfaces are tan colored and the interior is highly burnished. On the exterior, the outer lip edge and the burrs along the incised lines show luster from light polishing. As previously indicated in regard to the decorative incision, the exterior surface was lightly smoothed with a yielding tool when still plastic. The interior surface also shows plastic flow characteristic of such smoothing. Apparently both vessel surfaces were smoothed when wet, and finished when dry by polishing with a hard object.

Body Sherds. As mentioned above, most body sherds could not be positively assigned to a specific vessel, although many seemed to be parts of Vessel 1. Generally these sherds showed the same surface treatments, range of hardness, color, and texture as did the rim sherds. However, several of the larger ones that appeared to be pieces of Vessel 1 showed bare temper grains flush with the sherd surface, indicating that the vessel's body had been well smoothed by rubbing with a hard tool while the paste was still plastic.

A few body sherds showed necks and shoulders, but these could not be reassembled. Body sherd thickness varied from 3.5 mm to 11 mm with the thicker sherds probably representing shoulder and basal portions of the pots.

Area A

A small but heterogeneous group of eight sherds was recovered from three adjacent squares in Excavation Unit 2. The largest of these sherds measures 1.5 by 2 cm but all others are less than 1.5 cm in size.

The fact that each sherd shares at least one attribute with another in the sample, and the small area from which they were recovered suggests that they are from the same vessel.

Vessel 4. The eight small sherds from Vessel 4 range from 3.5 to 7 mm in thickness. All are body sherds but their small size and limited number preclude any inferences as to vessel form or size. Vessel paste is moderately fine grained and slightly blocky but well bonded. In these characteristics it is about midway between Vessels 3 and 6. Paste is fired black throughout and sparsely tempered with small particles of crushed granite. Unlike other vessels from 24PR627 the temper grains are burned and blackened. Since temper grains in other vessels were not discolored due to vessel firing, it seems likely that the temper for Vessel 4 was burned prior to inclusion in the paste. Temper in Vessel 4 is small grains averaging about 1 mm in size. Hardness is 3.5.

Interior and exterior surface color ranges from grey to black. Surface treatment is difficult to determine on these small sherds but random striations and areas of slight luster indicate that both the vessel's exterior and interior surfaces were scraped while the paste was leather-hard and then finished by polishing with a hard tool after the vessel had hardened.

Area C

Ceramic remains representing two distinct vessels were recovered from the surface in Area C in association with bone chips and lithic debitage.

Vessel 5. A total of 34 small body sherds was recovered from a small eroded area on the southwest edge of Area C. Lichen growth on several sherds indicates that they had lain exposed for a long period.

Despite this exposure and the resultant weathering evident to a limited degree on all sherds, the surfaces of several remain well preserved.

The sherds range in size from 6 mm to just larger than 2 cm. They represent a well-made, thin-walled vessel of indeterminate proportions. No rim neck, shoulder, or basal sherds are present. Thickness ranges from 3.5 to 6 mm. Paste is fine grained, compact, well bonded, and fired black throughout. It is heavily tempered with finely crushed granite particles that range in size from microscopic to nearly 3 mm. The majority of temper grains, however, are smaller than 1.5 mm. Hardness is 3.

Surface treatment is nearly identical on all sherds. The exterior surfaces show barely perceptible elongate ridges and grooves suggesting that it was textured with a grooved paddle. Both exterior and interior surfaces have a smoothed matte finish with numerous temper particles evident. Shepard (1965:188) indicates that these characteristics can only result when the vessel is carefully rubbed with a hard tool while the paste is still yielding but not too plastic. Support for the inference that the paste had hardened somewhat before rubbing is provided by the fact that the paddle marks were not entirely obliterated.

Vessel 6. This pot is represented by two large body sherds recovered from a gopher mound approximately 50 m north of the Vessel 5 sherds and across the deep dry wash that bisects this area of the site. Both sherds are between 2 and 3 cm in size and between 5.5 and 8.5 mm thick. Neither shows any evidence of weathering, hence they probably had not been exposed on the surface very long. Vessel shape and size cannot be determined from the collected sherds, but they are markedly more robust than Vessel 5 sherds and their curvature suggests that they represent

basal or shoulder portions. Paste is coarse grained and blocky textured but well bonded. It is fired black throughout and laminae are evident in cross section. The crushed granite temper occurs in moderate amounts. Temper particles range from 1.5 to 6 mm but the majority are larger than 3 mm. Surface color ranges from ashy grey to black. Hardness is 3.5.

Surface treatment is identical on both sherds. Exterior surfaces show pronounced elongate ridges and grooves, apparently the result of modeling with a grooved paddle similar to that used on Vessels 1 and 5. Both vessel surfaces were further modified, however, and show relatively deep, straight, sharply defined striations in combination with pits and ragged grooves where temper grains have been pulled out of or dragged through the paste. These characteristics indicate that both surfaces were scraped with a hard sharp object when the paste was leather-hard.

Comparison

The Highwalker pottery represents a Late Prehistoric period ceramic tradition widespread in this area of the Northwestern Plains. Similar ceramics have been recovered from south of the Yellowstone River in Montana (Mulloy 1953, 1958) and from numerous sites in north-central Wyoming (Frison 1976, 1979). Ceramics like those from Highwalker have been attributed to the Crow, although there is some question as to the validity of this ethnic affiliation (Wood and Downer 1977:88-89; Johnson 1979).

As a group the six vessels from the Highwalker site constitute well-made utilitarian pottery. No two vessels are identical, but all share a large constellation of characteristic attributes. All were lump modeled with paddle and anvil, as evidenced by the absence of coil welds, the presence of interior laminar texture, occasional surface

spalling, and the fact that a few sherds split longitudinally. The vessels are relatively thin-walled jars with restricted orifices and globular bodies showing vague shouldering. Rims are moderately high, with slightly S-shaped, straight, or flaring form. Lips are flattened or slightly rounded, and decorated in two of three cases. Decorative motifs include series of notches or oval punctates pressed into the lip, incised parallel line decoration on one vessel's shoulder, and possibly vertically oriented paddle marks on another rim.

Although specific surface treatment varies slightly on each of the vessels, as a group they show a consistent method of manufacture. Apparently after modeling and decorating of the lip, the interior and exterior surfaces were wiped (three vessels), scraped (three vessels), or rubbed (two vessels) when almost dry. Following this treatment, four of the vessels were finished by polishing. Vessel paste is fine grained and usually compact, with only a single vessel showing slightly blocky paste texture. Hardness ranges from 3 to 4 on Moh's scale. Surface coloration was apparently relatively uniform across the entire vessel (prior to soil discoloration and post-use burning of some sherds) and the reddish-brown "firing clouds" characteristic of other Northern Plains pottery (e.g., Keyser 1979a:81-102) are absent. Temper is finely crushed granite. As a group these characteristics indicate well-made, well-fired pottery of some sophistication.

There are several ceramic traditions represented by collections from this area of the Northwestern Plains (Johnson 1977; Mulloy 1942, 1958; Frison 1976, 1978:64-69, 1979) but the Highwalker site pottery appears most closely related to what Frison (1976, 1979) has called Crow Pottery. However, because there is some question as to the spatial and

temporal integrity of this designation, and its worth as an interpretive tool (Wood and Downer 1977:88; Johnson 1979), it would be profitable to distinguish the Highwalker ceramics from the ceramic traditions to which they are apparently not related before attempting to discuss Crow Pottery.

The Highwalker site ceramics do not appear to be related to the "Mortlach" ceramic tradition found at sites in Northeastern Montana (Johnson 1977) because they lack the characteristic attributes of thickened lips and cord-roughened bodies, and the decorative techniques of dentate stamping and cord impression. In addition, one Highwalker vessel has a slightly S-shaped rim profile which is an attribute not found in Mortlach ceramics (Johnson 1977:46).

Likewise, the Highwalker ceramics are not part of the Intermountain Tradition (Mulloy 1958:196-201; Frison 1978:64-67). Technologically the Highwalker site pottery is far superior to Intermountain Tradition ceramics, and the vessel shapes, rim forms, and decorative motifs characteristic of the Highwalker ceramics are not found on Intermountain Tradition vessels. In fact, Intermountain Tradition pottery is easily distinguishable from Crow Pottery (that is very similar to the Highwalker ceramics) when they are found together in sites in Wyoming (Frison 1976:41).

The Highwalker site ceramics could be included in the Mandan-Hidatsa Tradition as defined by Mulloy (1942, 1958:195-196). As has been demonstrated, however, (Johnson 1979; Alex 1979) this designation has little utility in terms of defining inter-assemblage ceramic relationships since a wide variety of only grossly similar pottery (including some of which is identified as Crow Pottery) has been grouped within it by Mulloy (1958) and others (Frison 1978).

The Highwalker ceramics are similar to what has been called (Frison 1976, 1979) Crow Pottery. This ceramic tradition is defined on the basis of fewer than 100 vessels recovered from sites in north-central Wyoming and southeastern Montana that share generalized characteristics of vessel form, manufacturing techniques, decoration, and surface treatment (Frison 1976, 1979). In fact, with the exception of their slightly more gracile form, the Highwalker vessels are nearly identical to the "Crow" type collection ceramics from Big Goose Creek, a campsite in the headwaters area of the Tongue River, just 110 km southwest of 24PR627.

As alluded to above, however, there is some question as to the validity of the designation of Crow Pottery. Basically these concerns are: (1) whether the ceramics in question really constitute a single entity (Johnson 1979:23-24; Wood and Downer 1977:88), (2) whether any or all of them can be ethnically identified as Crow (Johnson 1979:25-26; Wood and Downer 1977:88), and (3) what are the relationships of this pottery to Missouri River ceramic complexes from which it is assumed to have been derived (Wood and Downer 1977:88; Johnson 1979:23-25). Because the Highwalker site ceramics are reliably dated and closely resemble the Big Goose Creek type collection on which the Crow identification is primarily based, we feel that they may provide some insight into these concerns.

The nature and extent of possible relationships between the so-called Crow Pottery and various Middle Missouri ceramic complexes have yet to be explored in detail, although Wood and Downer (1977:88) document generalized resemblances between examples of Crow Pottery and its "probable antecedents along the Missouri River." In addition, Johnson (1979:23-24) indicates that at least two of the vessels reported from Wyoming are

examples of formally defined Middle Missouri wares, but that as such, they are foreign to the locally manufactured pottery from Big Goose Creek and other sites. Generally, however, the lack of effort devoted to determining possible relationships between Northwestern Plains and Middle Missouri ceramics seems to reflect the relatively small and often poorly dated ceramic collections from High Plains sites and the unfamiliarity of most Northwestern Plains archaeologists with Missouri River ceramic classification schemes. Recognizing this, we have attempted an assessment of some of these possible relationships. We stress, however, that neither of us claims expertise in Middle Missouri ceramics and neither of us has access to large comparative collections. Hence, we have relied in large part upon the assistance of colleagues who were willing and able to share their knowledge and to introduce us to their limited comparative collections. Thus, this discussion must be recognized as a preliminary statement, provided because it seems warranted at this stage in the development of our knowledge. We hope our discussion generates a more detailed analysis.

As an initial step in our analysis, we feel it necessary to define and describe the ceramic entity localized in this area of the plains in a manner that does not presuppose ethnic affiliation, age, or relationships to other defined ceramic wares or types. In this light, the adverse reaction to the definition and use of the terms Crow Pottery and Mandan-Hidatsa Tradition (e.g., Johnson 1979; Wood and Downer 1977: 88-89), indicates that neither designation is adequate. Therefore, given the fact that a majority of this pottery (including the type collection from Big Goose Creek) has been recovered from sites in and adjacent to the Powder River Basin, we use the term Powder River Tradition for the

pottery locally manufactured and used by groups inhabiting the High Plains area roughly bounded by the headwaters of the Powder River on the south, the Black Hills to the east, the Yellowstone River Valley to the north, and the Absaroka-Beartooth Mountains to the west (see Frison 1978:Fig. 1.1 and 1979:Fig. 1 for detailed maps of this region).

After examining the published descriptions of ceramic assemblages from this area, we suggest that the Powder River Tradition includes the ceramic assemblages from the Highwalker, Big Goose Creek, Piney Creek, Ten Sleep Creek, Medicine Lodge Creek, Pictograph Cave/Empty Gulch, and Seven Springs sites (Frison 1976; Mulloy 1958). In addition, parts or all of several small pottery collections from excavated sites in the Yellowtail Reservoir/Bighorn Canyon area (Brown 1969; Husted 1969), surface collections from northwestern Wyoming sites (Frison 1976, 1979), and collections from Pryor Gap and Thirty Mile Mesa in Montana (Mulloy 1958:196) probably also belong to this tradition although insufficiently detailed description or inadequately documented provenience precludes positive assignment. Finally, there are numerous sites in the area that are reported to have small amounts of pottery somewhat similar to Powder River ceramics (e.g., Alan Carmichael, personal communication 1980; Larry Lahren, personal communication 1979; Fredlund and Fredlund 1974: 31-32) but these are as yet unpublished or only sketchily described. Often they represent single vessels broken into sherds too small for detailed attribute identification and description (e.g., rim/lip form, decorative motifs). Their small number and insufficiently detailed description preclude the affiliation of these ceramics with any defined tradition at present.

Specifically excluded from the Powder River Tradition are Intermountain Tradition vessels found throughout the area and occasionally in site assemblages (e.g., Big Goose Creek, Empty Gulch) dominated by Powder River ceramics (Frison 1976:41, Mulloy 1958). Also excluded are individual vessels and ceramic collections from several sites (e.g., Hagen, Ash Coulee, Ludlow Cave) that have detailed similarities of form, manufacture, and decoration to certain Middle Missouri wares (Frison 1976; Johnson 1979:23-24; Wood 1971; Wood and Downer 1977:85-89; Alex 1979). In fact, some of these ceramics appear to represent site unit intrusions into this area by Middle Missouri ceramic-using groups (Wood and Downer 1977:89).

In general, then, Powder River ceramics are well-made, thin-walled globular jars with vague to distinct shoulders. Constricted necks form restricted mouths. Rims are usually moderately high, and slightly S-shaped, straight, or flaring. The rim on one vessel and the shoulder on another are decorated with incised parallel line designs, but cord-impressed designs do not occur if Johnson's (1979:24) identification of the Newcastle Vessel (Frison 1976:36-37) as an intrusive Fort Yates ware vessel is correct. Lips are usually flattened or rounded but few examples are slightly thickened or tapered to a point. Often the lip is decorated with incised, punctate, or cord-wrapped paddles that produced simple-stamped or, less commonly, check-stamped surface treatment patterns. Most vessels also show some secondary surface modification (e.g., wiping, brushing, scraping) and many were lightly polished after drying. Some technological deterioration is apparent through time as evidenced by the increased bulkiness and increased variety of surface treatments and lip forms on the most recent vessels (Frison 1976:36-37).

Although there has been an attempt to group some of the Powder River ceramics into wares based on rim form and decoration (Johnson 1979:24) this effort failed to take into account the variability in these ceramics so that one "ware" is, in fact, represented only by a single vessel and a large group of vessels with undecorated S-shaped rims is unclassified. Since the presence of a Highwalker site vessel with an outflaring rim and shoulder decorated with incised parallel lines further blurs this distinction the tenuously defined wares are not used in our analysis.

In general terms, the earliest Powder River Tradition ceramics (those from the Highwalker and Big Goose Creek sites) resemble Riggs Ware and to a lesser extent Fort Yates Ware of the Extended and Terminal variants of the Middle Missouri Tradition. Every attribute characteristic of the Big Goose Creek and Highwalker ceramics is duplicated in the published descriptions of the pottery from several major Extended and Terminal Middle Missouri villages between the Cheyenne River in South Dakota and the Knife River in North Dakota (e.g., Wood 1967; Wood and Woolworth 1964; Caldwell et al. 1964; Hurt 1953; Meleen 1949; Sperry 1968; Calabrese 1972). It should be noted, however, that several attributes characteristic of various Fort Yates and Riggs types (e.g., filleted and castellated rims, applique node and tab appendages, cord-impressed rim decorations) do not occur on Powder River ceramics.

Given these apparent similarities, we provided an opportunity for Chris Dill (Chief Archaeologist, State Historical Society of North Dakota) and Bob Alex (South Dakota State Archaeologist) to examine the Highwalker site pottery and compare it to collections they had available.

In an attempt to avoid biasing their analysis, they were not told the age of the site until after they had examined and commented on the pottery.

Dill (personal communication 1980) felt that the Highwalker site ceramics had no resemblance to Knife River Ware, since they lack the characteristic braced and filleted rims and check-stamped surface finish. His opinion is supported by the lack of resemblances between all Powder River ceramics and the published descriptions and illustrations of Knife River Ware from sites in the Knife-Heart region (Dill 1975:32-40, Plate 2; Lehmer et al. 1978:182-199, 374-383). The reported resemblance between Taylor's (1979:36-39) newly defined Eidelbrock Ware and the Big Goose Creek ceramics is apparently an error, since it is based largely on the mistaken notion that dentate stamping occurs on the Big Goose Creek site pottery. The fact that the Highwalker and Big Goose Creek sites date 200 to 600 years earlier than the Knife River phase serves to further separate these ceramic traditions.

On the other hand, Alex (personal communication 1980) and Dill indicated that Powder River ceramics are not especially similar to either Initial Middle Missouri or Early Coalescent Tradition ceramics, despite the fact that there is some temporal overlap between these entities and the Powder River Tradition. The absence of cord roughened surfaces, everted lips, and angular rim-shoulder junctures seems to distinguish Powder River ceramics from Initial Middle Missouri Wares, and the absence of braced rims, vertically brushed necks, and complex decorative patterns of incisions and cord impressions distinguishes Powder River pottery from the various Coalescent Tradition Wares.

Both Alex and Dill felt, however, that there were general similarities between the Highwalker site ceramics (and by extension, much of the other Powder River pottery) and Riggs and Fort Yates Wares of the Extended and Terminal variants of the Middle Missouri Tradition. Dill indicated that the form, decoration, temper, paste texture, coloration, and hardness of the Highwalker ceramics produced a distinctive pattern that was more similar to Riggs Ware than any other Middle Missouri pottery with which he was familiar. In addition, he provided examples of trailed and incised line decorations from the Huff (see also Wood 1967:73-74; Sperry 1968:49), Paul Brave, and Demery sites that closely resembled the incised decoration on the shoulder of Vessel 3 from the Highwalker site. Alex essentially echoed Dill's opinion by noting that the Highwalker ceramics, although demonstrating their own distinct pattern of attributes, more closely resembled Extended Middle Missouri ceramics than any other pottery from the Missouri Trench area in South Dakota.

Both Dill and Alex felt that the date of A.D. 1043 from the Highwalker site was early, but within the range of the earliest dates for Extended Middle Missouri villages such as Helb, Paul Brave, and Jake White Bull (Theissen 1977:64, 67; Ahler 1977a:127-130). The Big Goose Creek site dates (Frison 1976:43; Wood and Downer 1977:87) fit comfortably within the range of A.D. 1100-1600 for the Extended and Terminal variants of the Middle Missouri Tradition.

Discussion

In themselves, the Highwalker site ceramics do not provide definitive answers to any of the several questions of prehistoric cultural dyamics subsumed under plains archaeologists' concern about "Crow" pottery. In the context of other ceramic assemblages from the Northwestern

Plains and Middle Missouri areas, however, they do provide data on which to base a tentative model that may be relevant to some of these issues. In order to present this model, however, it is first necessary to summarize the present state of knowledge regarding the ceramic using group(s) in the Powder River Basin area of the Northwestern Plains.

Several alternative schemes have been proposed in one form or another to account for the presence and appearance of the ceramics we group into the Powder River Tradition. Basically these compose two major hypotheses:

1. Introduction and subsequent deterioration of Crow ceramics following a single migration.

This hypothesis, best summarized by Johnson (1977:46), almost amounts to folklore among Northwestern Plains archaeologists. Without becoming directly involved in the complexities of when and how the Crow split from the Hidatsa, this hypothesis, as Johnson (1977) indicates, is based on the assumption that the Crow left the Missouri River with a well-defined ceramic industry, but that over the years as they gradually adapted to the pedestrian (later equestrian) lifeway of the plains, ceramics became less functional, hence gradually less carefully made. Finally, the craft was abandoned.

Archaeological evidence supporting this hypothesis should be sites with relatively large amounts of well-made Middle Missouri pottery (and other artifacts) that represent the initial migration, followed by sites that date later and have smaller amounts of pottery representing a degenerate technology. The culmination would be sites without pottery representing Crow occupation after abandonment of their ceramic industry.

Historically, the Hagen site was thought to represent the initial Crow movement onto the Plains (Mulloy 1942; Malouf 1963). Frison (1967a, 1976) argues that the Powder River (Crow) ceramics from northern Wyoming represent the stage of degenerating ceramic technology.

2. Multiple Crow migrations and continuing contact with Middle Missouri groups.

This hypothesis, most clearly proposed in several recent works (e.g., Wood and Downer 1977; Hanson 1979), is the result of synthesis of archaeological, ethnohistorical, and linguistic data that did not fit comfortably into the original single migration hypothesis. Essentially, this scheme proposes multiple migrations onto the Plains by groups who split from the Hidatsa over a period of several hundred years. No attempt is made to infer the actual number of groups who split, or to date these migrations, except to note that ethnohistoric and linguistic evidence indicates that there were distinctions between the River Crow and Mountain Crow, and the final Crow-Hidatsa schism occurred after A.D. 1700.

Presumably the archaeological evidence in support of this hypothesis should include an original ceramic complex directly related to a group of Middle Missouri Wares that showed, over the years, repeated influences derived from evolving Middle Missouri ceramic industries. These influences would have been incorporated into the Crow ceramic industry as it slowly deteriorated. Obviously this hypothesis is closely related to the first, its major distinction being the postulation of continuing influence of Middle Missouri technoeconomic systems on Crow material culture.

The currently available archaeological evidence, including the recently recovered Highwalker site data, does not strongly support either hypothesis. The single migration hypothesis has been shown to be too simplistic in light of the accumulated archaeological, ethnohistoric, and linguistic evidence (Wood and Downer 1977) and the multiple migration hypothesis, although more attractive in terms of recognizing the complexity of the probable population movements, cannot account for the variability and temporal span of Powder River Tradition ceramics and the fact that Powder River ceramics are not ultimately traceable to a single source (Frison 1979).

Hence, in light of the new data from the Highwalker site and the further deviation from the above summarized hypotheses, we offer a third possibility as a working model that more closely conforms to the existing archaeological data. In doing so, we acknowledge that some of the seminal ideas in our hypothesis are present in recent statements by Johnson (1979) and Frison (1979:11-14).

Johnson (1979:25) notes that there are numerous Northwestern Plains sites containing a wide variety of ceramics ranging from Woodland pottery, through Intermountain Tradition pottery, to classic examples of various Middle Missouri Wares. She further notes that ceramic use on the Northwestern Plains apparently spans the last 1700 years.

Given this time span and the various ceramic industries present, the Powder River Ceramic Tradition is neither unique nor exceptionally early in the cultural sequence for this area. Apparently the Powder River Tradition was introduced to the region sometime around A.D. 1050 by a group or groups who had contact with village farmers of the Extended variant of the Middle Missouri Tradition. This early date corresponds

to the earliest Extended Middle Missouri villages in the Cannonball district of the Missouri Trench (Theissen 1977; Ahler 1977a). An earlier origin for this pottery, in the Initial variant of the Middle Missouri Tradition is unlikely considering the absence of characteristic Initial Middle Missouri traits such as cord roughening, rim form, and decoration.

As Frison (1979:12) indicates, it is unlikely that the Crow (as we know this group from the Historic period) were the originators of the Powder River Ceramic Tradition. The early date for the Highwalker site supports this interpretation, since we have no evidence that the Hidatsa were one of the groups responsible for the Extended variant of the Middle Missouri Tradition (Dill 1975), and the linguistic evidence suggests that the Crow-Hidatsa schism had not yet begun (Wood and Downer 1977; Mathews 1979:123). Instead, the evidence suggests that an ethnically unidentifiable group is responsible for the earliest Powder River Tradition ceramics. Whether this group consisted of immigrant Middle Missouri farmers, immigrants from another area who had previous contacts with Middle Missouri groups or their antecedents, or a local Powder River Basin population who interacted with the Middle Missouri villagers, is not known, but the generalized nature of the ceramic resemblances suggests that one of the latter two alternatives is most plausible. Data to answer this question may well exist in sites along the Grand and Cheyenne Rivers that head in the Black Hills/Slim Buttes area on the eastern periphery of the Powder River Basin, since these are the most likely routes between the Powder River Basin and Cannonball region of the Missouri River.

Regardless of the source of this population, it is likely that contact between people in these two areas was initiated and maintained by groups who made periodic forays into adjacent areas--either from the Missouri River onto the Plains of western North and South Dakota, and eastern Wyoming and Montana to hunt bison, or from the Powder River Basin to the Missouri River to trade (or raid) for horticultural produce and other items. In this manner, the hunters of the Powder River Basin maintained a ceramic complex that shared traits with the evolving Middle Missouri ceramic industries.

Sometime after A.D. 1400, the Crow moved from the Missouri River area to the Plains in what appears to be a series of small-scale migrations (Taylor 1979; Wood and Downer 1977). Quite probably the first Crow (or Proto Crow) immigrants shared the pine parklands area with the indigenous group or groups who already had a history of contacts with Middle Missouri village farmers, and it is tempting to suggest that part or all of the Crow migrations were accomplished by accompanying the Powder River Basin people back to the Plains following their visits to the Missouri. The extreme social fluidity characteristic of Plains Indian Societies (Oliver 1962) documented in ethnohistoric accounts of Northern Plains Indian groups (Sharrock 1974; Heidenreich 1979: 89-100) provides a model whereby the early Crow and an unidentified group(s) could have coexisted in the area even as ethnically mixed bands some or all of the time. Gradually more and more Crow moved into the area introducing Coalescent Tradition ceramic traits into the Powder River ceramic tradition. Eventually they become the dominant ethnic group, either incorporating the unidentified originators of the Powder River Tradition, or driving them from the area.

The available archaeological evidence best fits this model. The Highwalker site represents a group of the originators of the Powder River ceramic tradition camping in the Tongue River uplands in the eleventh century A.D. The group occupied the site in the fall in order to stockpile bison products (meat, marrow, bone grease) for the coming winter. The late season and distance from the Missouri River suggest that these people were completely adapted to a full-time bison hunting economy and were not intent on wintering in villages along the Missouri. The distinctiveness of this group's ceramics indicates that they were only generally familiar with the extant Extended Middle Missouri village potters with whom they shared ceramic attributes. This suggests that these people were not Missouri River farmers-turned-hunters, since the near contemporaneity of the Highwalker site and the earliest Extended Middle Missouri village would not allow sufficient time for the divergence and evolution of the Powder River ceramics from a parent Extended Middle Missouri Ware. Instead, this supports the idea of an indigenous Powder River Basin group affected by their contacts with Missouri River villages.

During the following period (from A.D. 1100 to A.D. 1500) occasional travel from the Powder River Basin to the Missouri River (or vice versa) to trade and raid maintained the communication of ceramic traits into the Powder River Tradition. A trade system that would have facilitated this interchange has been documented for the Northern Plains by several authors (e.g., Wood 1972, 1974; Ewers 1954; Dill 1975) as involving the flow of horticultural produce, lithic raw material, and pottery technology to the plains nomadic groups in exchange for meat products, hides, and various "exotic" items (e.g., elk teeth, mountain sheep horn, obsidian,

dentalium, grizzly bear teeth and claws) desired by the Middle Missouri villagers. Although the major postulated trade items are perishable foodstuffs, evidence of which is not usually preserved, nonperishable items have been found in sites in both areas that indicate the operation of this trade system. These include the Fort Yates and LaRoche Ware vessels from the eastern Powder River Basin (identified by Johnson 1979:23-24) and the Knife River flint at the Highwalker site, and elk antler, elk teeth, mountain sheep horn, and small amounts of porcellanite and obsidian from Extended Middle Missouri villages (Wood and Woolworth 1964; Lehmer 1966; Ahler 1977a:92-107).

Later, after A.D. 1500, the Crow began moving into the Powder River Basin, and the Hidatsa (and probably other groups) utilized the area on an occasional basis (Heidenreich 1979:98-100). This influx of people and the continuing trade system introduced the coalescent ceramic traits (e.g., check-stamping) that occur in the latest Powder River ceramics such as those from Medicine Lodge Creek (Frison 1976:36, 1979:8) and the Bighorn Canyon (Husted 1969:75-76). That these immigrants could have affiliated with indigenous groups on the Powder River Basin is demonstrated by the extensive ethnohistoric evidence for polyethnic bands (Sharrock 1974; Heidenreich 1979:98-100). The co-occurrence of Intermountain Tradition and Powder River Tradition ceramics at several sites in the area (Frison 1976:41; Mulloy 1958:82-85) archaeologically documents the ethnic mixture of some late prehistoric period Powder River Basin groups.

In light of these Late Prehistoric period migrations, the Hagen site apparently represents a movement into the Yellowstone Valley (on the northern periphery of the Powder River Basin) by a group of Missouri

Trench farmers. Whether the site's primary occupants were Crow, Hidatsa, another immigrant group, or a combination of these is not known, and a wide variety of possibilities exists to explain the site's presence (Heidenreich 1979:103), but it seems likely that there would have been some diffusion of ceramic (and other) traits from the Hagen site occupants to the local nomadic groups. Nevertheless, the influx of new people (Crow and probably Hidatsa) and new ideas (coalescent ceramic traits) may well have resulted in the dilution of Powder River ceramics evidenced by the new attributes and increasing number of attribute combinations found on the latest examples of this pottery (Frison 1967a, 1976:35-36, 1979:6-7). In addition, the pottery also apparently degenerated technologically over time, presumably as a result of the makers gradually adapting to a nomadic lifestyle (Frison 1979:8, 13).

Finally, the introduction of the horse and gun which initiated a technoeconomic system emphasizing mobility and reliance on white traders resulted in the rapid replacement of pottery with metal utensils and the consequent disappearance of the Powder River ceramic tradition.

Bone Tools

Three bone tool fragments were recovered from the site deposits. One is a small, thin, highly polished, flat bone chip with a small hole drilled in it. The nearly rectangular chip is broken through the hole and on two other sides. It is polished on both faces. Function is unknown. The second tool is a small, broken tip from a blunt awl or similar instrument. The worked tip is less than 1 cm long and slightly polished. The tool fragment is lightly charred, apparently prior to breakage. In addition to being broken across one end the tip is split longitudinally along part of one side. The third tool fragment is a

small, thick, roughly rectangular bone chip, less than 1 cm in maximum dimension. The piece is broken along two edges and shows highly polished bevelled edges on the other two margins. The upper surface of the chip also shows light polish. The tool was lightly charred prior to modification. Function is unknown.

Bone Debris

Some 10.67 kg of bone (including a few teeth and tooth enamel fragments) were recovered from our excavations at the Highwalker site. Although bone was found in every excavation unit, more than 98 percent of the recovered sample came from Excavation Unit 1. Less than 20 gm was recovered from Excavation Unit 2 in Area A. Burned and unburned bone chips resembling the excavated sample were also noted on rodent mounds in Area C.

Bone recovered from the Highwalker site included both burned and unburned specimens, and nearly all of it was crushed and broken into small pieces. More than 75 percent consisted of fragments less than 1.5 cm in size; only 44 specimens were complete enough for specific identification. Most of the bone from the site was burned. Evidence of burning ranged from limited black discoloration due to light charring to an ashy grey-white color and powdery texture indicative of total incineration in a hot fire (Baby 1954). Differences in the intensity of burning seem to be accidental rather than intentional. The only evident modification of the unburned bone was light sawing or cutting marks, crushing, and splintering.

For purposes of analysis the recovered bone sample was separated into burned and unburned classes, then size-graded and weighed. Results of this analysis (Table 8) show that more than 70 percent of the recovered

TABLE 8

Bone Analysis

	Highwalker Site	One Bear Site
Burned Bone	7,485.35 gm (70%)	74.3 gm (52%)
> 13 mm	8%	4%
6-13 mm	40%	35%
3- 6 mm	42%	61%
1- 3 mm	11%	-
Unburned Bone	3,185.4 gm (30%)	67.35 (48%)
> 13 mm	74%	65%
6-13 mm	11%	18%
3- 6 mm	11%	18%
1- 3 mm	4%	-
Total	10,670.75 gm	141.65 gm

bone was burned, and of this more than 90 percent was broken into pieces smaller than 13 mm. The absence of indication of differential charring on the broken edges indicates that these pieces were broken prior to burning. The clearly defined, relatively sharp edges evident on most burned chips and the occurrence of small, extremely fragile fragments of cancellous tissue indicate that the chips were not "milled" after burning. These characteristics demonstrate that the considerable effort expended to crush this bone occurred prior to its incineration.

Only 30 percent of the Highwalker site bone was not burned. In contrast to the burned bone, approximately 75 percent of the unburned bone is large splinters and unbroken bones greater than 13 mm in size. Most of the large unburned fragments are dense bone that would have been difficult to crush (e.g., longbone shaft splinters, longbone articulations); the remainder are skeletal elements that would not have yielded large quantities of marrow or grease when processed (e.g., astragulus, phalanges, mandible). The broken longbone splinters have the cancellous tissue removed and the nearly intact articular ends of several longbones show deep gouges in the exposed cancellous marrow-bearing tissue. These characteristics and the association of the fragments with pottery indicate that the bone was initially broken to remove marrow, and then crushed into small fragments for boiling to extract grease. This grease extraction process and the resultant artifactual evidence has been described in detail by Leechman (1951) and Vehik (1977). Following grease production most of the crushed bone was burned.

Only 44 skeletal elements could be identified as to species (Table 9). These include 40 bison bones, an antelope scapula, the humerus from a large owl, and two gopher bones. Because the gopher bones show no

cultural modification (e.g., charring, cut marks), they are presumed to be postoccupation introductions into the site area and are thus omitted from the analysis. The antelope scapula and owl humerus are broken, apparently from the butchering process, and indicate the occasional use of these food sources by the Highwalker site occupants. According to Russell Graham (personal communication 1980) the owl humerus is probably from a Great Horned Owl. Owl remains occur relatively frequently in Northern Plains sites where they were used both for food and as a source of feathers (Parmalee 1977:214-216).

The recovered bone debris indicates that bison were by far the most important food source utilized by the Highwalker site occupants. Although some of the more gracile burned bone chips possibly represent deer, antelope, or even smaller game, the majority of recovered bone scrap consists of large robust chips that represent crushed bison longbones. In the absence of evidence for either cultural or natural (carnivore) factors disturbing the bone scatter and thereby biasing our sample, we feel that the preponderance of bison bone accurately reflects an emphasis on the procurement and processing of bison.

The recovery of the distal articular ends of three adult left tibia, and the presence of the calf mandible and a smaller-than-adult lateral maleolus indicate the presence of a minimum of four bison. This figure probably does not truly represent the total number of animals used at the site, since so much of the bone was crushed and there are large areas of intact deposit remaining, but it does indicate that the group here was undertaking a relatively small-scale bison procurement and processing operation. This interpretation is supported by the nearly complete processing and utilization of the few animals available.

TABLE 9

Identifiable Faunal Elements
Highwalker Site

Species/Element	Left	Right	Indeterminate
Bison			
Mandible	1		
3rd Cervical Vertebra			1
Carpal Cuneiform		1	
Patella		1	
Tibia	3		
Astragulus	2	1	
Calcaneous	1	1	
Lateral Maleolus	2		
Magnum	2		
Naviculo-cuboid	2		
Tarsal Cuneiform	1	1	
Metatarsal	1		4
Proximal Sesamoid			2
Distal Sesamoid			1
1st Phalanx	5	2	
2nd Phalanx	1	1	
3rd Phalanx		2	
Antelope			
Scapula		1	
Owl			
Humerus			1

In these respects the site contrasts to large-scale communal bison procurement/processing sites such as Piney Creek (Frison 1967b) where hundreds of animals were killed and individual carcasses were less completely utilized.

The recovered bison bone and its distribution throughout Excavation Unit 1 provide insight into bison butchering methods and utilization patterns at the Highwalker site. The occurrence of so few recognizable skeletal elements and the fragmentary nature of most of the recovered bone preclude study of the primary butchering process such as those undertaken at kill sites elsewhere on the Northern Plains (Frison 1970b, 1973; Keyser and Murray 1979), but some information is available about the final processing and the methods of bone marrow and grease extraction.

In the northeastern portion of Excavation Unit 1 the unburned bone was scattered across a butchering "floor" in a pattern showing disarticulated rear leg units that reflect the general pattern in which these units had been butchered. Longbone articular ends (e.g., distal tibia) were loosely associated with their complementary articulations or elements (e.g., astragulus, calcaneous, proximal metatarsal), but the shafts had been crushed and the splinters removed for boiling. This distribution, coupled with the limited weathering observed on the bones, indicates that this arrangement did not suffer extensive disturbance from humans, carnivores (especially dogs), or sheet erosion.

Numerous cut marks on the bone chips and several of the larger elements in the butchering area indicate that the bones were extensively scraped and sawed in the process of removing soft tissue and the periosteum. Utilized flakes recovered in large numbers throughout the processing area, and in direct association with several butchered bones

(Fig. 14) were apparently used for this. Following soft tissue removal the bones were broken over large, naturally-occurring sandstone anvils. We recovered no hammerstones, but there were several large anvils on the butchering floor, around which were clustered small piles of bone fragments. Deep gouges in the cancellous tissue in the recovered tibiae and several phalanges indicate that marrow was removed with stone or bone tools. Then the splintered bone was crushed and boiled to render grease.

The magnitude of bone crushing and burning indicates extensive bone marrow extraction and bone grease production. Longbones are represented only by articular ends which contain little marrow and are too dense to be easily broken for grease extraction. Longbone shafts were apparently split to obtain marrow and then smashed beyond recognition in preparation for rendering grease. Further support for our inference of marrow and grease production is that the only intact bones recovered were dense skeletal elements (e.g., phalanges, sesamoids, astraguli) with little or no marrow content. In fact, recovery of several burned smaller bones (e.g., sesamoids, a magnum, a tarsal cuneiform) in association with the burned bone chips in one hearth suggests that they had been boiled to render grease even though intact. The boiling of these small bones and the breaking of several phalanges to obtain their minimal marrow content are testimony to the intensity and completeness of marrow/grease extraction.

The reason for burning the bone chips after grease extraction is not readily evident. If the burning was intentional (as the quantity and careful treatment of the bone suggests) we could conceive of only three possible functions--food source, ash for hide tanning, fuel source--and none of these is fully supported by the available data. According to Vehik (1977) bones are boiled but not burned in the grease

rendering process, and it seems unlikely that burning would have produced any additional food value. Most of the bone was not reduced to ash that might have been used in hide tanning. Finally, although there are ethnographic references to the use of bone as fuel for fires, this usually occurs in fuel-deficient areas such as the Arctic and apparently involves only uncooked bone. The use of wood in both hearths at the site documents that firewood was available in the area, and the fact that the bone was boiled before burning would seem to make it less suitable for use as fuel since much of the grease content would have been removed. However, use as a fuel source seems to be the most reasonable alternative.

The recovered skeletal elements indicate that the lower hind legs were the focus of the grease processing activities in Area B of the Highwalker site. Of the recovered bones, only a carpal cuneiform, a mandible, several rib fragments, and a cervical vertebra represent any part of the carcass other than the hind quarters. All other identifiable bones are lower rear leg elements between the tibia and phalanges. If this selection is representative of the entire site (as seems likely given the absence of other skeletal elements from other excavation units or the surface of Area A) it suggests that the bison were killed some distance from the site and only select portions of the carcasses were returned for processing. The lower leg units, which are light-weight, yet rich in marrow, were apparently preferred. The nearly complete processing of the bones also suggests that only limited portions of the carcass were available for processing at the site.

The recovered bison mandible represents a young animal and this provides a clue to site seasonality. The specimen has three cheek teeth

present. The fourth deciduous premolar (DP4) is fully erupted and moderately worn. The first molar (M1) is approximately three-fourths erupted with wear restricted to polishing on its first cusp. No wear facet is evident on this cusp. The second molar (M2) is unerupted with the first cusp just visible below the jaw line in the opening behind M1. When compared to the tooth eruption schedules calculated for prehistoric bison populations elsewhere on the Northwestern Plains (Frison and Reher 1970; Reher 1973, 1974) this sequence indicates that the animal was between five and seven months old. Given the bison's restricted calving season this suggests the animal was killed during the fall of this year sometime between September and December.

Gastroliths

Some 23 small polished quartz pebbles were recovered from Excavation Unit 1. These pebbles, clustered in three areas of the unit, are between 2 mm and 8 mm in diameter and show varying degrees of polish. According to Custer Forest Geologist Mike Burnside (personal communication 1979) the pebbles are not native to the site area. There is no stream in the vicinity that would produce gravel like this, and pebbles like these are not found in the Fort Union Formation sandstones in this area.

The most likely explanation for these pebbles is that they represent gastroliths (gizzard stones) from a medium-sized gallinaceous bird. P. L. Wright, University of Montana Zoologist, indicated (personal communication 1980) that there was little information available about avian gastroliths, but he did agree that this seemed to be a likely explanation for the pebbles. He also indicated that turkeys were not native to this area prehistorically, and that sharp-tailed grouse were the most likely avian source for these stones. We were unable to obtain

sharp-tailed grouse gizzard stones for comparison, but gizzard stones from similarly-sized ring-necked pheasants showed the same shape, polish, and size range as the archaeological specimens.

Gastroliths similar in size and shape to those from Highwalker have been recovered from False Cougar Cave in the Pryor Mountains of south-central Montana. At that site they are associated with large numbers of blue grouse bones indicating extensive use of this avian food resource (Rob Bonnichsen, personal communication 1980).

The occurrence of these stones and their distribution in the site suggest at least one sharp-tailed grouse was killed and eaten by the site's occupants who discarded the gizzard or its contents in the site area.

Distributional Analysis

In an attempt to better understand the function of the Highwalker site, we calculated density distributions to elucidate intrasite patterning of the recovered artifact classes. Because Excavation Unit 1 was composed of 45 contiguous 1 m squares that form a large excavated plaza in which differential densities would show overall patterns, we focused our effort there (Figs. 15-19). References to other areas of the site or other excavation units are included only to show significant variation between site Areas A, B, and C. In the area excavated to 20 cm depth, artifact densities show similar patterns in both the 0-10 cm and 10-20 cm level. This supports our inference that the latest occupation of the Highwalker site produced a sufficient quantity of artifacts to mask the ephemeral patterns of the earlier Archaic period occupation. Results follow for the analysis of lithic debitage, bone scrap, ceramics, and chipped stone tools.

Lithics

More than 94 percent of the recovered lithics were from Excavation Unit 1. Smaller numbers found in other excavations indicate that none of these other tested areas was as much a focus of tool maintenance as the eastern portion of Area B.

Debitage clustered along the southern edge of Excavation Unit 1, in the area adjacent to and between the two firehearths (Fig. 15). In light of the clustering of patterned tools in this same area, it seems likely that this distribution represents the greater necessity of maintaining and rejuvenating tools that were used in tasks conducted near the hearths. Fewer waste flakes in the butchering area in the northern portion of the excavation unit correspond to the preponderance of utilized flakes that were used in the butchering process and discarded without extensive resharpening. The abundance of debitage and tools around the hearths probably also indicates that this area was the focal point for tasks (e.g., limited wooden tool manufacture and repair) ancillary to the butchering and grease processing that are the predominant activities conducted in this site area.

Bone

The large volume of bone recovered from the site shows a distinctive distribution of burned and unburned fragments (Fig. 16) that clearly indicates the emphasis on bone grease manufacture, and provides insight into the methods of grease procurement. Nearly all of the recovered bone is from Excavation Unit 1. The paucity of bone scrap in other excavation units indicates that butchering and grease production activities were not emphasized in Area A and the western portion of Area B. Broken bone fragments on the surface in Area C suggest that butchering and bone grease extraction may also have been conducted there.

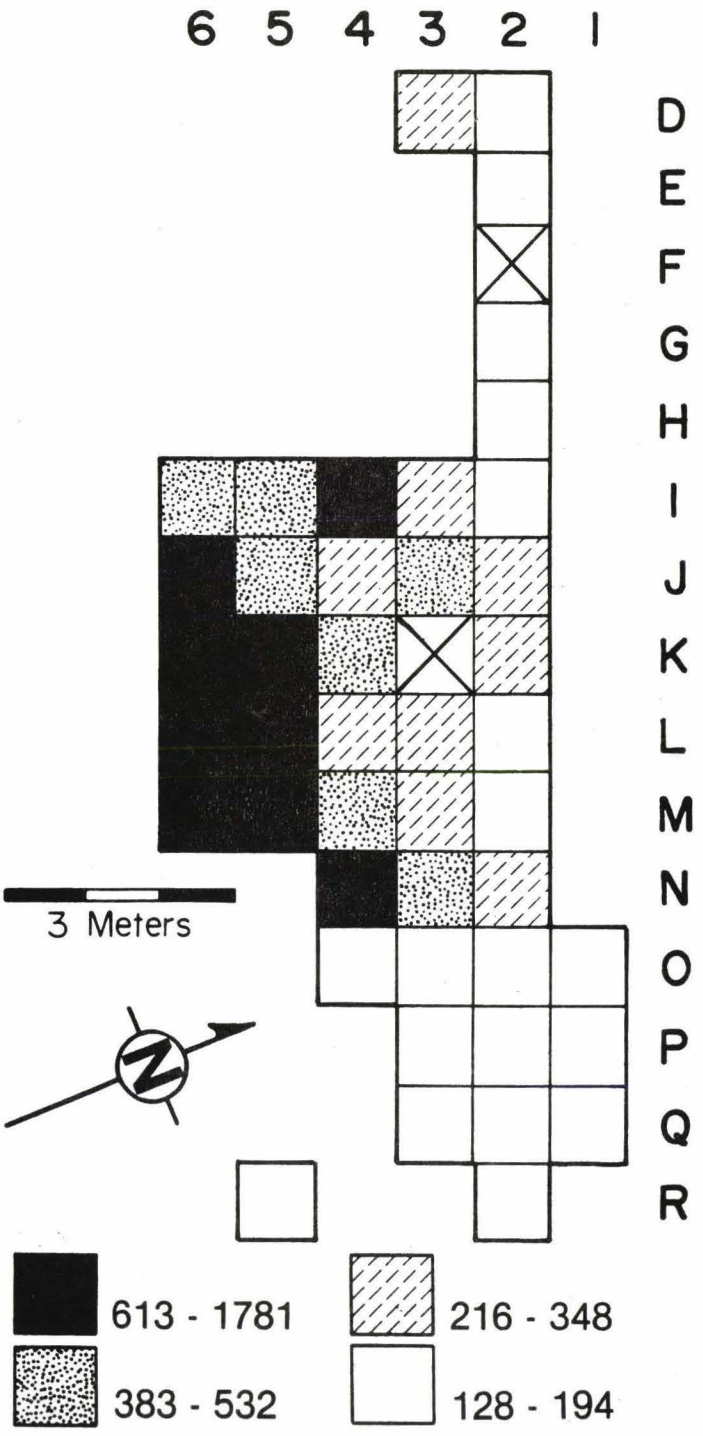

Fig. 15. Density distribution of lithic debitage at the Highwalker site. Shading represents numbers of debitage elements. Rows O-R and squares F2 and K3 were excavated only to 10 cm depth, hence they are not included in the analysis.

Unburned bone occurs throughout Excavation Unit 1, but it is concentrated in the northeastern portion where nearly 75 percent of the recovered unburned bone is clustered in 15 contiguous 1 m squares. The bone composing this cluster consists predominantly of large robust long bone splinters and dense skeletal elements (e.g., tibiae articulations, astraguli) that have no marrow or which could not be further rendered to produce grease. Smaller unburned chips also occur but they are concentrated in the vicinity of the firehearth where the concentrations of burned and unburned specimens overlap. These unburned chips are less than 1.5 cm in diameter and appear to have been crushed and boiled to extract grease. They compose less than 30 percent of the unburned bone sample.

In contrast to the unburned bone scrap, burned bone is clustered near the large firehearth in the south-central portion of the excavated area. Here, 14 contiguous 1 m squares yielded more than 95 percent of the burned bone, most of which consists of small chips less than 1 cm in size. These bone chips were apparently crushed and boiled to extract grease, then burned for reasons that cannot be determined.

The areal distribution of bone fragments demonstrates that the butchering/crushing and boiling/burning activities were spatially segregated operations. The fact that the crushed and boiled chips were the only bones burned further suggests that the burning occurred after the butchering/crushing process was completed. Coupled with the size distinction between burned and unburned bone samples this distribution also suggests that the incineration of these bones was not merely for garbage disposal or camp cleanup. Finally, the occurrence of the unburned chips in the area of overlap between the burned and unburned

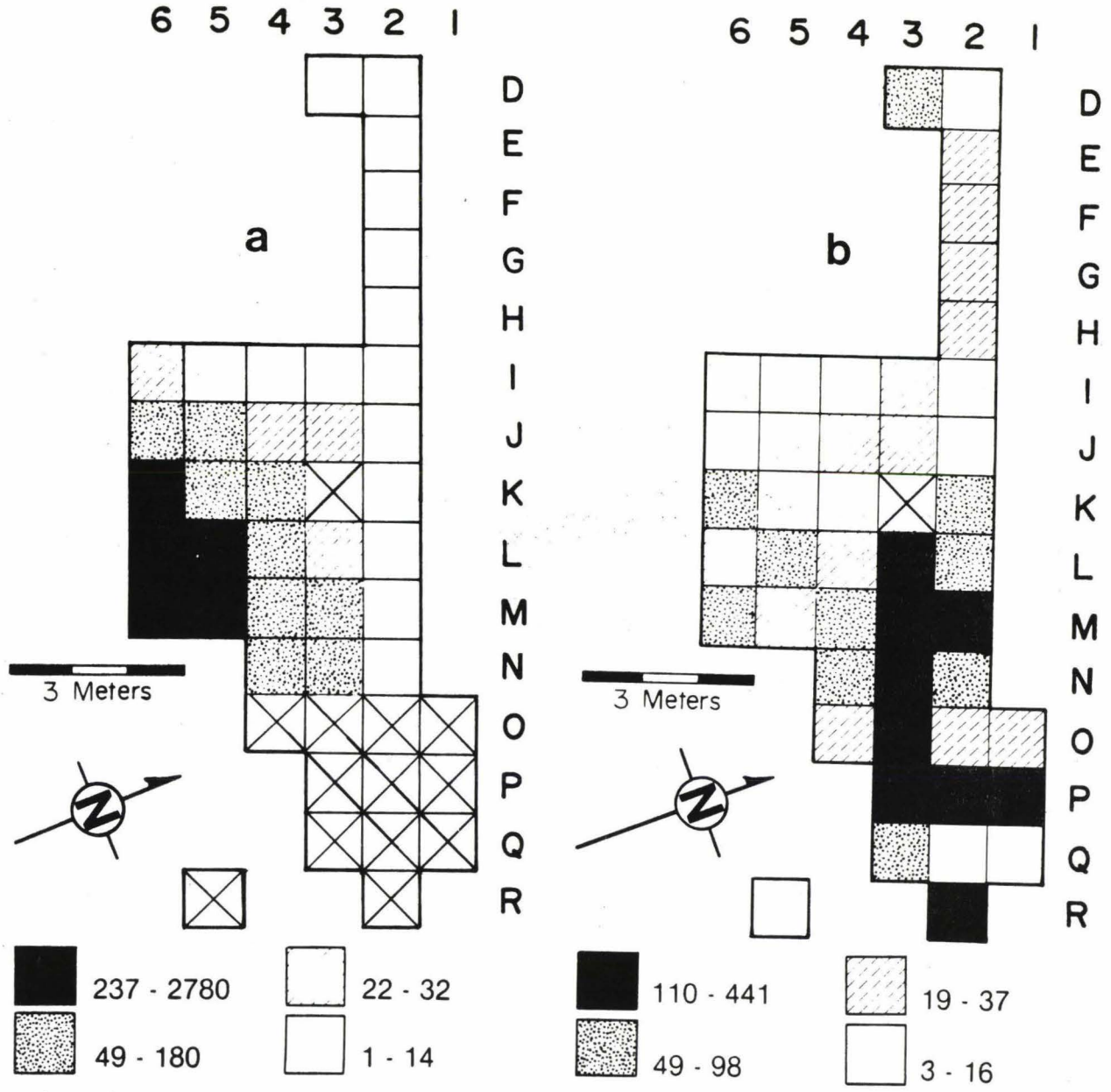

Fig. 16. Density distribution of bone debris at the Highwalker site. Distribution a is burned bone, b is unburned bone. Shading represents weight of bone in grams. Squares with X's not included in analysis.

bone clusters, coupled with the absence of large fragments near the hearths, indicates that the bone was crushed in the butchering area and transported to the hearth area for boiling and burning.

Ceramics

Although ceramics were found in all three areas of the site, more than 88 percent of the sherds recovered from subsurface context were clustered in 13 contiguous 1 m squares in the east-central area of Excavation Unit 1 (Fig. 17). These sherds are clustered just north of the largest hearth and in the area where the concentrations of burned and unburned bone overlap. This distribution indicates that the vessels were used as containers in which bones were boiled to render grease. Furthermore, the rimsherd distribution shows slight separation of the three recognizable vessels in this cluster rather than a random mixing of broken vessel fragments, indicating that the sherd distribution reflects pots broken during use rather than a trash heap of randomly deposited sherds.

The two concentrations of surface sherds in Area C, coupled with their association with bison bone fragments, suggest that activity areas similar to that exposed in Excavation Unit 1 occur in Area C. The presence of eight small sherds scattered throughout Excavation Unit 2 in Area A implies the periphery of a ceramic use/disposal area or, alternatively, that the distribution reflects sheetwash erosion.

Chipped Stone Tools

More than 92 percent of the subsurface chipped stone tools were found in Excavation Unit 1. The five tools from Excavation Unit 2 include four utilized flakes and a flake geometric tool. The absence of patterned tools coupled with the paucity of bone fragments in Area A

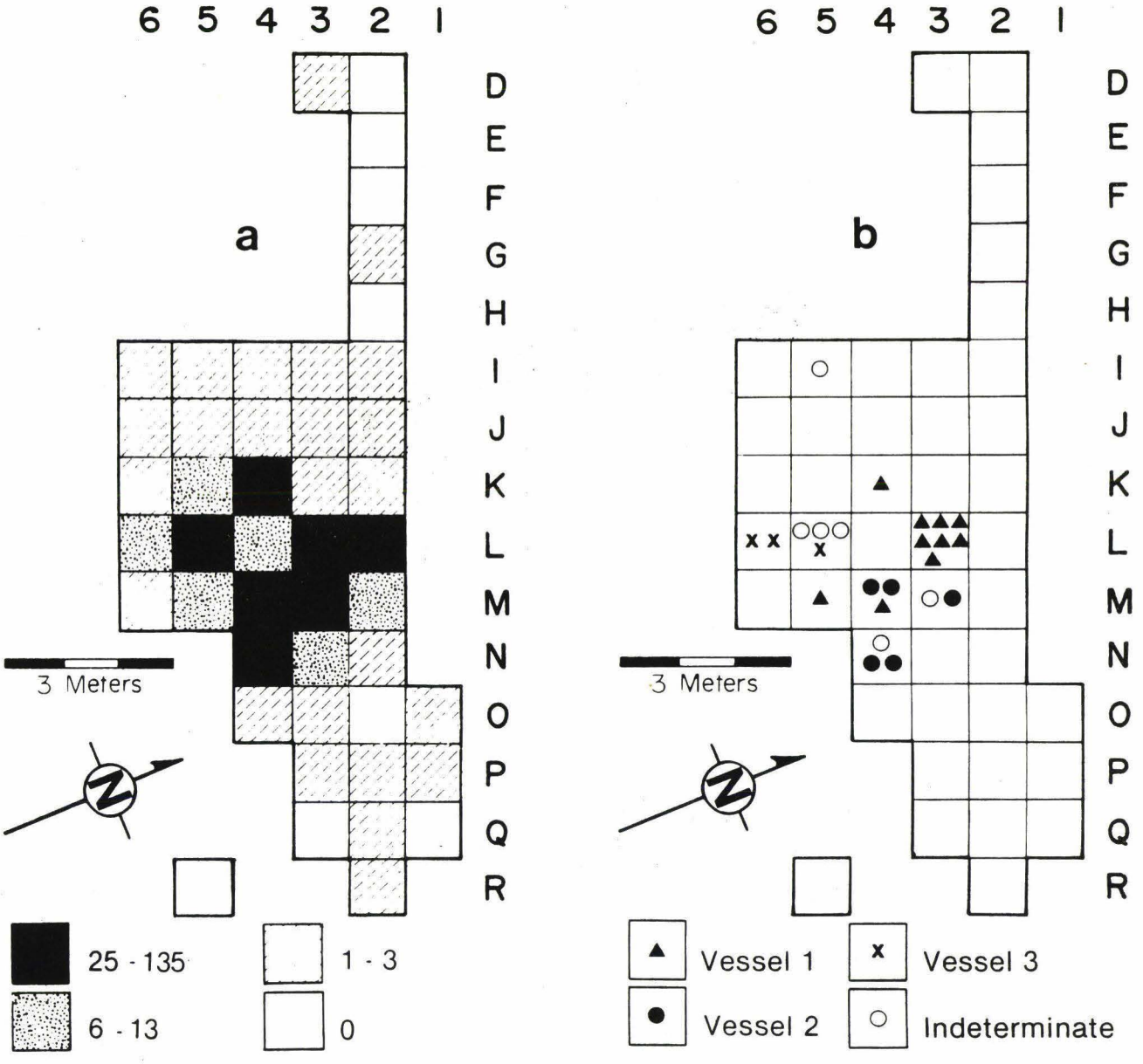

Fig. 17. Density distribution of Highwalker site pottery: a is total sherd distribution, shading represents numbers of sherds; b is rimsherd distribution, symbols represent actual rimsherds.

supports other evidence indicating that it was not used for the same sets of activities as Area B.

For one level of analysis chipped stone tools from the site can be divided into two categories: unpatterned (or flake) tools and patterned tools comprising those implements that involve secondary stages of bifacial or unifacial flaking. Flake tools show three clusters in Area B (Fig. 18). One, whose function is unexplained, consists of six utilized flakes in Test Pit 1. The two larger clusters are in Excavation Unit 1. The first is associated with the butchering floor; the other is scattered around the firehearths. These clusters indicate that flake tools functioned in a variety of tasks, but their predominance in the butchering area indicates that they were the favored tool for butchering and bone grease processing activities. Support for this interpretation is provided by the small numbers of waste flakes in the butchering area that indicate limited maintenance of patterned tools.

The emphasis on using unmodified flake tools in the butchering process is consistent with recent studies that show such implements to be far more effective in butchering tasks than bifacially flaked, patterned tools (Walker 1978).

Patterned tools cluster around the firehearths (Fig. 18) and in the extreme northwest end of Excavation Unit 1 (Sq. D2, D3). The latter cluster consists of nine implements showing twelve working edges: five biface blades, a projectile point reworked into a knife, four endscrapers, and two perforators. In this tight cluster seven of the tools are unbroken and three have multiple, functionally different working edges. This cluster is unique in the site, suggesting that it may represent an integrated tool kit cached or discarded here.

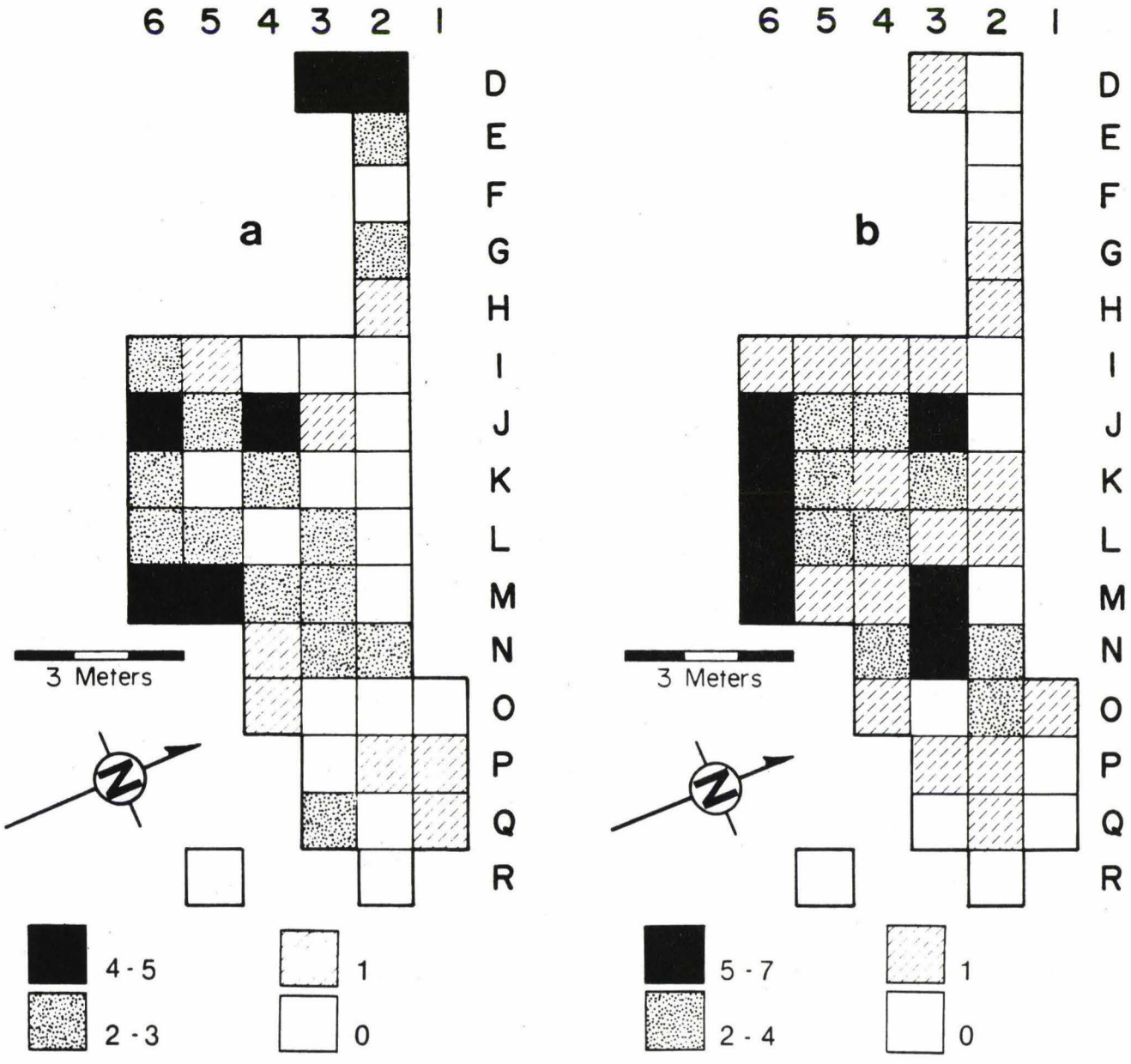

Fig. 18. Density distribution of Highwalker site tools: a shows patterned tools, shading represents number of tool elements; b shows utilized flakes, shading represents number of utilized flake tools.

The cluster of patterned tools around the hearths consists primarily of biface blades and scrapers used in tasks not directly related to the bone processing activities. The number of scrapers suggests that preliminary hide processing was conducted here, an observation consistent with the likelihood that hides were returned to the site along with meat and bone products.

As described above, tool clusters are readily recognizable in the excavated area, but the nature of relationships between functional tool types or classes is obscured by the gross dichotomy between patterned and unpatterned tools, and the widespread distribution of the flake tools. Hence, we felt that additional analysis would be profitable based on a further refinement of these broad categories.

Therefore, in an attempt to elucidate activity sets represented by the patterning of tools, we utilized statistical significance tests to determine if systematic relationships existed between the various chipped stone tool classes. This analysis is focused on the main plaza area of Excavation Unit 1--25 contiguous 1 m squares comprising rows I through M (Fig. 19)--because this area was excavated to a uniform depth of 20 cm and is large enough to show areal patterning.

In our analysis, we compared the number of 1 m squares which contain a certain tool association with the number of squares where this association is absent (e.g., the number of squares containing utilized flakes and biface blades was compared to the number of squares containing only utilized flakes or only biface blades). A Chi-square test of significance on a 2x2 table was computed to determine whether a significant relationship existed between the two tool classes in question. If a relationship was present, a Phi (θ) statistical value was calculated

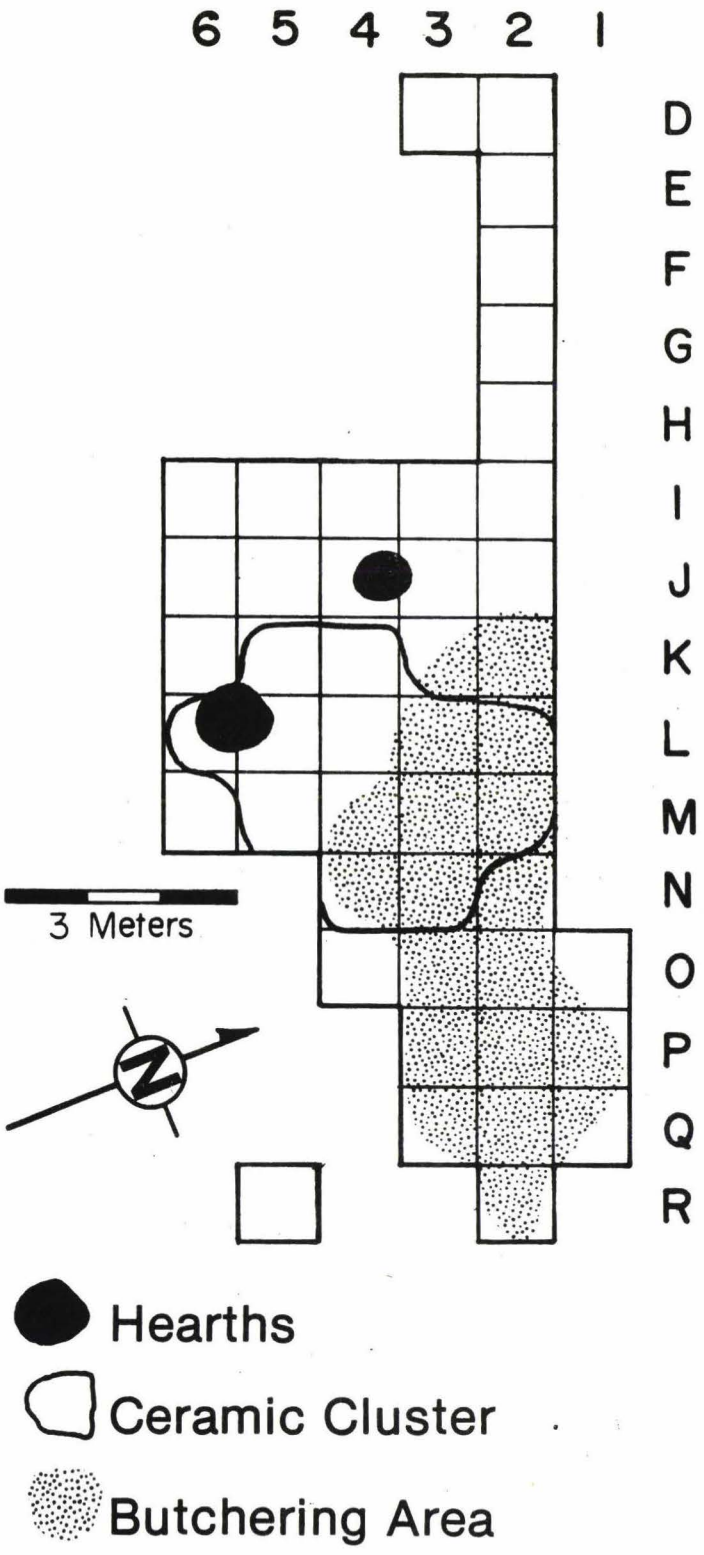

Fig. 19. Highwalker site artifact and feature distribution.

to provide a comparable measure of strength of association (from a no-association value of 0 to a +1 value for a perfect association [see Nie et al. 1975:224]). By comparing the measures of association between 1 m squares sharing a particular tool combination with those units where the tools exist as discrete entities, a general estimate of tool class interrelationship was established. Since all other evidence strongly indicates that the site, and particularly this area, represents a short-term use, a strong tool association would imply either that the tools were used in the same activity set (e.g., hide-working) or that they were used in the same site area in a sequence of temporally related but discrete activity sets (e.g., butchering, hide-working). The special purpose nature of the Highwalker Site, coupled with the spatially discrete activity areas indicated by bone debris and tool clusters, implies that associations are more likely to reflect integrated activity sets rather than sequentially related discrete activities.

Because more than half of the chipped stone tool classes identified at Highwalker are represented by only a few specimens (particularly those with a fairly specific function such as burins or gravers), statistical calculations comparing the 13 identified tool classes would be meaningless in many instances. Hence, for this level of analysis we lump the 13 tool classes into four major categories based on morphology, method of production, and general function. These categories (and the tool classes they subsume) are: biface blades, utilized flakes, scrapers (sidescrapers and endscrapers), and special purpose tools (flake geometrics, bifaces, notched pieces, perforators, burins, and gravers). Projectile points are omitted from this analysis because they relate more to offsite activities than onsite activities, and drills and discoids are omitted because the only examples are surface collected specimens.

Utilized flakes compose the largest category. At least one such tool, and usually more, occurs in 22 of the 25 1 m squares we included in this analysis. They show the same general strength of association with biface blades (θ.33), scrapers (θ.40) and special purpose tools (θ.32). Significantly, however, they are likewise found in squares where each of these other tool categories is absent (θ.33, θ.25, and θ.29, respectively). Although we know that utilized flakes were used for butchering activities almost to the exclusion of other tools, the associations show that they were also generalized all-purpose tools that performed in a wide variety of tasks in combination with all three categories of patterned tools. This is consistent with their almost incidental method of manufacture and their wide range in size, shape, and use wear.

Biface blades are also common at the site, but their associations with other tools show a different pattern. Relatively few biface blades were found in association with scrapers and a Phi (θ) value of 0 on the Chi-square test results indicates that statistically they are independent of one another. This suggests that these tools were used in discrete, spatially separated activities. The only exception to this is the tool cluster at the northwest end of Excavation Unit 1 (outside our sample area) that contained five biface blades and four endscrapers--two of each which were combination endscraper/biface blade tools. This unique association lends tentative support to our suggestion that this cluster represents an integrated tool kit not used in butchering activities.

An equally interesting, but positive, association occurs between biface blades and special purpose tools. This Phi value is 1.0 and

indicates, therefore, a perfect association between these two categories. Unfortunately the special purpose tool class is composed of so many functionally different tool types that little can be predicted as to the functional meaning of this association. Certainly the special range of activities indicated by some of these tools (e.g., notched pieces, flake geometrics) implies that a bifacial knife blade was an important part of most, if not all, tool kits. Larger samples of these various special function tools may enable a clarification of which tools are most strongly associated with biface blades.

The evidence indicates that scrapers are not associated with biface blades, but scrapers are equally associated with squares where special purpose tools are present (θ.70) and those where special purpose tools are absent (θ.50). This suggests that scrapers were used both with and without specialized implements.

In summary, these associations indicate that the tools composing the Highwalker site assemblage functioned in several discrete activity sets. Utilized flakes were used throughout the site in a wide range of activities both alone and in conjunction with patterned tools. They are clearly associated with the butchering process where they were the predominant implement employed, and they were probably also used with patterned tools in preliminary hide-working activities that accompanied the butchering process. They also serviced in a variety of poorly understood, but apparently special purpose tasks centered around infrequent specialized tools such as burins.

Biface blades and scrapers show a clear division in location (and thus activity set) but both are in close association with the special purpose tools. The strong association between biface blades and special

purpose tools indicates that the biface blade probably served as a general purpose knife in many different tasks. The scrapers appear to have functioned with all tool categories except biface blades.

Inferences and Interpretations

Analysis of the data recovered from the Highwalker site provides a basis for interpretations concerning the cultural-historical affiliation and type of site utilization.

Chronology

The recovered projectile point types indicate two periods of use of the Highwalker site. The three small, bulky corner-notched dart points indicate an occupation during the late Archaic period. Although no dates were obtained for this barely recognizable occupation, late Archaic components at other sites in the pine parklands area have been dated between 1500 B.C. and A.D. 700 (Frison 1978:56-62; see also One Bear site discussion, below).

The ceramics and side-notched arrowpoints associated with the major occupation at the site indicate a late Prehistoric period age for this component. Two radio-carbon dates (Table 10) indicate that this occurred during the eleventh century A.D. A sample of charcoal obtained from the prepared hearth yielded a corrected date of A.D. 1043±51 (Tx-3691). Because this date seemed somewhat early for ceramics of this type we submitted a sample of unburned bone from the butchering area located just north of the hearth. A corrected date on the apatite fraction of this sample is A.D. 885±304 (Tx-3984). The large standard deviation is attributable to the fact that less than three gm of apatite could be extracted from the submitted bone sample (Sam Valastro, personal communication 1980), but the bone date overlaps that obtained from the charcoal

within one sigma and, as such, supports the validity of the date on the hearth. The association of the butchered bones with the ceramics and the presence of several burned potsherds in the dated hearth demonstrate that this pottery-bearing component does, in fact, date to the period between A.D. 1000 and A.D. 1100.

Site Seasonality

A combination of factors indicates that the Highwalker site was occupied during the fall of the year. Winter season use seems unlikely since the open, basin bottom site locale is unprotected from the north and west winds that predominate during the period from December through March. Additionally, local informants indicate that the site area is usually snowed in during much of the winter. The sheltered, better drained buttes and ridges to the south and east, or the sheltered headwaters of Lyon Creek to the northwest would have provided numerous easily accessible campsites more propitious for winter occupation. Summer use also seems unlikely. Our experiences during excavation at the site in June and July are testimony to the extreme heat and lack of protection from the violent thunderstorms that blow in from the Bighorn Mountains on an almost daily basis. As with winter cold, the effects of heat and storms would have been less in a camp on the adjacent forested ridges and buttes. Furthermore, it is unlikely that there would have been water at the site during most summers. Mud Turtle Spring flows only seasonally, during the months of March-June and September-December, and in 1979, a wet year, spring flow was a stagnant trickle by the middle of July.

On the basis of available water and lack of shelter, then, either fall or spring appear to be more likely seasons for occupation, but the

evidence from the site points tentatively toward fall season use. It seems unlikely that a spring season camp would have had such emphasis on the production of bone grease. Ethnographic sources suggest that fall and winter were the major seasons for extensive bone grease manufacture (Vehik 1977:169-170)--an observation that may correlate with the higher overall fat content of animals during this part of the year (Vehik 1977:170) and the likelihood that the grease was used to make storable foods such as pemmican and a lard-like condiment (Vehik 1977:171). Elsewhere on the Northwestern Plains, extensive bone grease production is most often noted at fall or winter season bison processing sites (Keyser 1979a:64; Frison 1967b:35, 1978:234-239). In addition, tooth eruption analysis indicates that the recovered bison mandible is from a half-year-old calf, killed sometime between September and December. Although a single animal is insufficient evidence on which to base a seasonality determination, it does support our inference of fall season use based on environmental factors and the evidence of extensive bone grease production.

Site Utilization

The paucity of Archaic period artifacts at the Highwalker site precludes detailed inferences concerning this occupation. The projectile points suggest an emphasis on hunting. That only three specimens were recovered, coupled with the inability to assign any other artifact or feature to this occupation is tempting negative evidence suggesting that the occupation was transitory. However, the absence of evidence documenting depositional and erosional processes that may have affected the site's integrity prior to the later occupation preclude definitive statements.

The preponderance of well preserved artifacts from the Late Prehistoric period occupation provides detailed information about the site's use during this period. A constellation of factors demonstrates that Highwalker served as a short-term, fall season, special purpose camp for a group (or groups) processing bison meat products as a hedge against winter food shortages. As discussed above, the setting, available resources, emphasis on bone grease manufacture, and the age of a bison calf killed there indicate that the site was occupied in the fall, between September and December. The low density of patterned tools, high tool-to-debitage ratio, and moderate debitage density indicate a short-term base camp rather than a village site or transitory camp. This inference is supported by ceramic size analysis and the somewhat structured butchering floor, neither of which appear to have been extensively trampled or disturbed by foot traffic that would have occurred had this been a long-term occupation. The absence of indication of extensive dog scavenging and the limited displacement of the butchered bones also suggest a short-term occupation. Finally, lack of any refuse disposal of the butchered bone debris and broken pots, coupled with the minimal hearth-cleaning efforts documented by the quantity of incinerated bone chips in and around the prepared firehearth, also argue for short-term use with minimal camp maintenance.

The recovered artifacts reveal that the inhabitants of the Highwalker site were primarily engaged in butchering and processing bison meat and manufacturing bone grease. Compared to other large-scale bison processing sites on the Northwestern Plains (e.g., Frison 1967b, 1973; Keyser 1979), however, the butchering and grease procurement operation at Highwalker is obviously smaller in scale, even though only a small

portion of the site was excavated. This observation conforms to other evidence indicating a relatively short-term occupation.

The artifact patterning at Highwalker further indicates that it was a short-term occupation, but it suggests that it was the focus of a specialized set of activities rather than simply a generalized base camp. In a recent article, Vehik (1977) constructed a predictive model against which to compare archaeological sites containing evidence of bone grease procurement in order to help infer settlement type. According to her interpretation (Vehik 1977:173-175), grease manufacturing at a "special purpose" campsite is most likely to occur in a meat processing context. In such a setting, objects used in making the kill, butchering and skinning tools, preliminary hide processing tools, and the by-products of maintaining these implements should be found in direct association with the primary grease extraction tools. In addition, grease-exhausted bone fragments, whole and splintered bone elements, and broken, exhausted, or lost tools would remain in or near the activity area. Little effort would be devoted to waste disposal since the group involved would soon be moving on.

In contrast, in a "permanent" settlement (the polar opposite of a special purpose camp) bone grease production should occur in a broader cultural context (Vehik 1977:174) with a much wider variety of artifacts, camp debris, and site features present. The by-products of grease procurement would not be left in the main activity area but would likely be disposed of in trash pits or midden areas. Additionally, other kinds of campsite activities would tend to obscure the archaeological evidence for grease procurement.

The archaeological evidence for meat processing and bone grease manufacturing at Highwalker falls neatly within Vehik's special purpose camp model. Bone grease manufacturing at the Highwalker site occurred directly within a meat processing context. Our excavation revealed a well-defined butchering area adjacent to a firehearth (Fig. 19) which had been used to boil crushed bone in pottery containers. The butchering area was relatively intact and had not been masked by other activities, so the meat and grease processing sequence was readily distinguishable. The lower hindquarters of at least three bison and parts of a fourth animal were strewn across the butchering floor in a loose, disarticulated manner reflecting the general pattern in which they had been butchered. The bones recovered from this area were either dense skeletal elements (phalanges, astraguli) and articular long bone ends low in marrow content, or large, robust chips representing crushed long bone shafts. In adjacent areas, the bulk of the bone sample consisted of tiny crushed fragments.

The absence of a full complement of rear leg bones, coupled with the preponderance of small bone fragments, implies that most of these "missing" bone elements had been crushed to render grease during, or soon after, the final meat processing. Vehik (1977:170-172) notes that vertebrae, ribs, leg and foot bones were the major sources of bone grease, and suggests that absence of these elements in an archaeological site, except as dense articular ends and broken fragments, would be negative evidence verifying this preference. Our data seem to do just that.

Furthermore, the Highwalker site artifact assemblage is very similar to the special purpose camp tool kit suggested by Vehik (1977:173-174)

to reflect direct procurement and processing activities. Two side-notched arrow points and several tiny biface tips were scattered throughout the site and probably represent projectile points removed from the carcasses during processing. A few biface blades and large numbers of utilized flakes represent skinning and butchering tools. The presence of a few endscrapers and sidescrapers probably reflects some preliminary hide processing in addition to use of these tools in scraping periosteum from the long bones and extracting bone marrow. Several large sandstone slabs in the site deposit were associated with clusters of broken bone, indicating that they served as anvils, and others were probably used as hammerstones, although use wear could not be detected on the friable sandstone. Neither grooved mauls nor quartzite cobble hammerstones were found, but the scarcity of these tools throughout Custer Forest (Beckes 1976; McLean 1975) suggests that in this region, where suitable cobbles are rare, such items would have been a part of a group's portable baggage and removed from the site.

The distribution of the ceramics indicates that pottery vessels were used in the grease extraction process and the absence of fire-fractured or reddened cobbles indicates that direct boiling was used rather than secondary stone boiling.

Coupled with this discussion, a frequency histogram (Fig. 7) clearly shows that the tool assemblage consists predominantly of implements used directly in primary meat processing, grease extraction, and hide-working activities. Tools representative of secondary manufacturing and maintenance activities are rare (e.g., perforators, drills, burins) or absent (e.g., shaft abraders, whetstones, hide burnishers, knapping tools, ornaments). Such tools are commonly associated with

long-term bison processing, base camps elsewhere on the Northwest Plains (Keyser 1979a; Frison 1967b; 1973), and their absence at Highwalker documents the special purpose nature of this site.

The lithic debitage also supports the inference that the Highwalker site was used for a limited spectrum of activities. Tertiary and biface thinning flakes compose more than 99 percent of the debitage sample, indicating that tool maintenance rather than tool manufacture was the focus of the lithic industry. This emphasis indicates that the group arrived at the site with the necessary tools, focused their energy almost exclusively on butchering and grease processing activities, and left the site before undertaking many additional tasks that required newly manufactured tools.

Finally, the site features also support our contention. Two firehearths were the only structural features encountered. One of these was used in the grease production and the other, although lacking definite functional attributes, was probably used for cooking, or heat and light. The absence of storage pits, postmolds, hide smudging pits, trash pits or middens, and other structures commonly associated with more sedentary occupations on the Northwest Plains (Keyser 1979a: 62-68, 75-81; Frison 1973:53-57; Mulloy 1942:5-11) clearly indicates the limited range of activities conducted here during a short-term use.

In summary, then, the Highwalker site obviously represents what Vehik (1977:179) calls a special purpose, bone grease manufacturing site, and in fact it seems to fit her model even better than the Quast site which she used as an example. The only deviation at Highwalker was the presence of such a large quantity of burned bone which her model did not predict. Although the function of this burned bone is not clearly

demonstrated, our best explanation is that it served as fuel, and if so it indicates an additional reliance on the products generated by the butchering/bone-breaking activities.

The variety of lithic materials utilized by the Highwalker site occupants shows a heavy reliance on locally obtainable porcellanite, indicating that this group was familiar with the resources localized in the Pine Parklands region and exploited the local lithic resources in what has been termed casual direct procurement (Francis 1979). However, the fact that more than one-third of their lithic raw material (chert, quartzite, obsidian) was obtained from outside the local Tongue River/ Otter Creek drainage indicates that they were also exploiting areas peripheral to the pine parklands. The presence of a few primary and secondary flakes showing bedrock cortex indicative of deliberate direct lithic procurement in the Bighorn Mountains suggests that they traveled there. Additionally, much of the chert and quartzite with gravel cortex could also have been obtained from the river gravels and alluvial outwash along the eastern flanks of the Bighorn Mountains (the Tongue River headwaters region) during these trips. The Knife River flint and caramel colored petrified wood were most likely obtained through travel to northeastern Montana and western North and South Dakota and/or trade with groups living there. This inference is further supported by the relationship between the Highwalker ceramics and those from the Middle Missouri River area in South Dakota.

Given this evidence, it is apparent that the Highwalker site inhabitants had a wide interaction sphere that encompassed parts of four states (Montana, Wyoming, South Dakota and North Dakota). Using the co-influence sphere model proposed by Syms (1977:5-10), it seems that the

noted reliance on local lithic materials, coupled with the presence of this group in the Tongue River region conducting fall bison procurement to obtain winter food surpluses, indicates that the Pine Parklands region was their homeland. However, their wide-ranging contacts indicate extensive secondary and tertiary utilization areas that probably reflect both regular seasonal and sporadic exploitation of other regions. If Frison's (1979:8, 13) suggestions of an even increased reliance on local resources by the later bearers of the Powder River ceramic tradition are valid, then it appears that this cultural tradition gradually settled-in to the Powder River/Bighorn Basin through time. In Syms' (1977:6-7) scheme this would represent a group that moved into the Pine Parklands region and adapted to it as their homeland over a relatively long period during which their exploitation of secondary areas gradually decreased in importance. Further research is necessary to test this hypothesis and refine our knowledge of the origin and development of the late Prehistoric period cultural continuum marked by the Powder River ceramic complex.

Summary

The Highwalker site is a two-component occupation site located at the head of Lyon Creek in the Tongue River drainage of the Pine Parklands region of the Northwestern Plains. Artifacts recovered from the shallow ridgetop site deposit overlooking Mud Turtle Spring indicate that the site was first occupied by Late Archaic period hunters and later by a Late Prehistoric period ceramic-using group.

The Archaic period occupation appears to have been by a small group of transient hunters who used the site sometime between 1500 B.C. and A.D. 700. Little can be said about their use of the site except to note that it appears to have been a short-term occupation.

The later use represents a short-term, special purpose occupation somewhat more intensive than a simple transitory campsite but certainly less intensive than a permanent base camp or village. The site is quite large and consists of three areas, each producing almost identical cultural debris from the Late Prehistoric period occupation. Excavation in two portions of the site did not indicate whether these areas represent different subunits of a larger group using the site at one season, or reoccupation of the site several times by the same or related groups. Neither possibility can be discounted by the present evidence, and further research (especially in Area C) is necessary to answer this question.

Recovered artifacts indicate that the group(s) using the site focused their efforts almost exclusively on the butchering of a few bison carcasses and the processing of meat, bone grease, and hides. Evidence of the exploitation of other resources was limited to a single antelope scapula, an owl humerus, and a few sharp-tailed grouse gizzard stones. Chipped stone tools and debitage are the most common artifacts recovered and indicate an emphasis on the maintenance of butchering and preliminary hide-working tools with little or no indication of the manufacture or maintenance of tools for other purposes.

Environmental factors and the presence of a five- to seven-month-old bison calf indicate that the site was used in the fall. Two radiocarbon dates indicate that this occupation occurred between A.D. 1000 and A.D. 1100. Ceramics from the site are the earliest known representatives of a localized Powder River Basin ceramic tradition that appears to be related to Extended Middle Missouri Tradition ceramics. This relationship, coupled with the evidence of lithic raw material procurement

from areas in Wyoming and North and South Dakota, indicates that the people using the site had widespread contacts over much of the Northwestern Plains. They may, in fact, have been in the early stages of moving into and adapting to the Pine Parklands area as their homeland.

THE ONE BEAR SITE--24PR402

One Bear is a small, Late Archaic period campsite situated on a narrow, open terrace above Yonkee Spring (Figs. 20, 21). The site area is at the head of a short, deep, heavily forested canyon on the south side of the Taylor Creek Valley. Yonkee Spring flows fresh water year-round, but during most of the summer the volume is so small that running water is restricted to the upper few hundred meters of the canyon bottom. Access to the site is accomplished by a 1 km walk up the narrow canyon from Taylor Creek. From the site area the open uplands bordering the Taylor Creek Valley are within easy reach. Overall, the site seems optimally situated to take advantage of the water supply and shelter while still providing easy access to a variety of ecosystems.

Prior to excavation, evidence of human occupation at One Bear consisted of a light scatter of porcellanite and chert flakes eroding from the thin soil on the restricted, grass covered terrace above the spring. Surface reconnaissance showed most artifacts to be located along the southernmost terrace edge with markedly fewer flakes at the northern edge of the terrace, adjacent to the spring. The steep hillslope and erosion of the spring drainage cutbank probably precluded occupation right near the spring. In addition to the surface scatter of debitage an outcrop of medium-grade porcellanite on the steep hillslope across the drainage to the east of the terrace showed evidence of prehistoric quarrying.

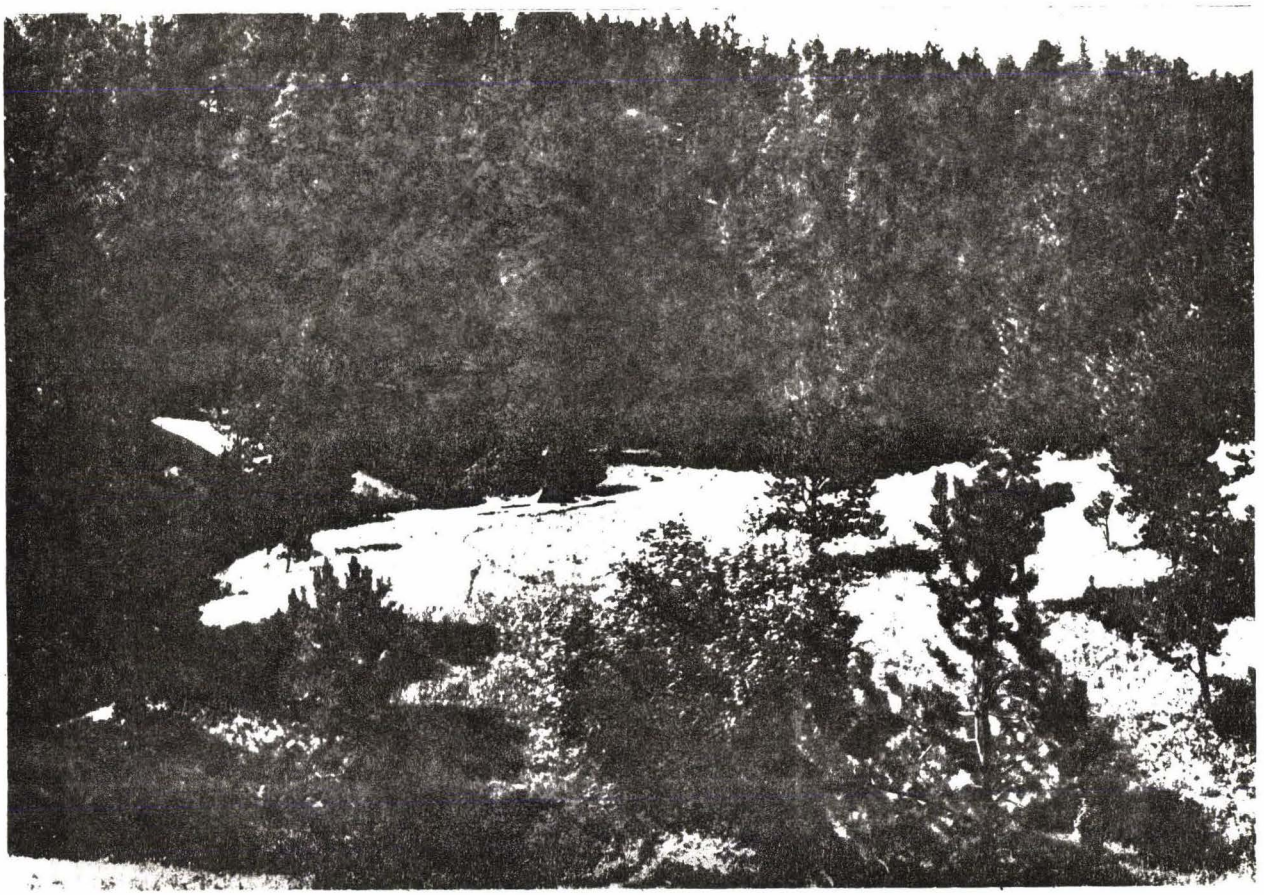

Fig. 20. One Bear site looking south across open, spring-side terrace. Arrow indicates major excavation unit.

Excavation

Three 1 m test pits were excavated by the authors at the One Bear site in the fall of 1978. These pits, dug to a depth of 10 cm, confirmed the presence of shallowly buried cultural material and plans were then made to excavate the site the following summer.

Excavation in 1979 was begun with a series of five small (1-3 m) test pits along a northwest-southeast trending baseline bisecting the narrow flat-topped spur at the southern edge of the terrace. Most of the surface artifacts were evident in this area. These pits are labelled Excavation Units 2 through 6. Later, when excavation demonstrated that the concentration of surface flakes here represented erosion of the terrace edge and probably also minor redeposition of flakes from the slightly higher central terrace area rather than a focus of occupation, we dug a pit nearer the center of the terrace which was expanded into a large plaza composed of 29 contiguous 1 m squares. This plaza is Excavation Unit 1.

Following completion of our excavation, we monitored construction of the Yonkee Reservoir Dam that destroyed most of the central terrace area. During this process we collected an additional projectile point and discovered a small pile of fire-reddened sandstone slabs that was excavated using hand tools. Overall, however, we noted very few additional artifacts indicating that our excavation had removed more than 50 percent of the site's primary culture-bearing deposit.

Stratigraphy of the One Bear site is very simple. The upper 16-22 cm of the deposit was a light brown sand-clay loam with a large complement of angular scoria "pea" gravel derived from the hillslopes above the terrace. Disturbance of this deposit was minimal and restricted to

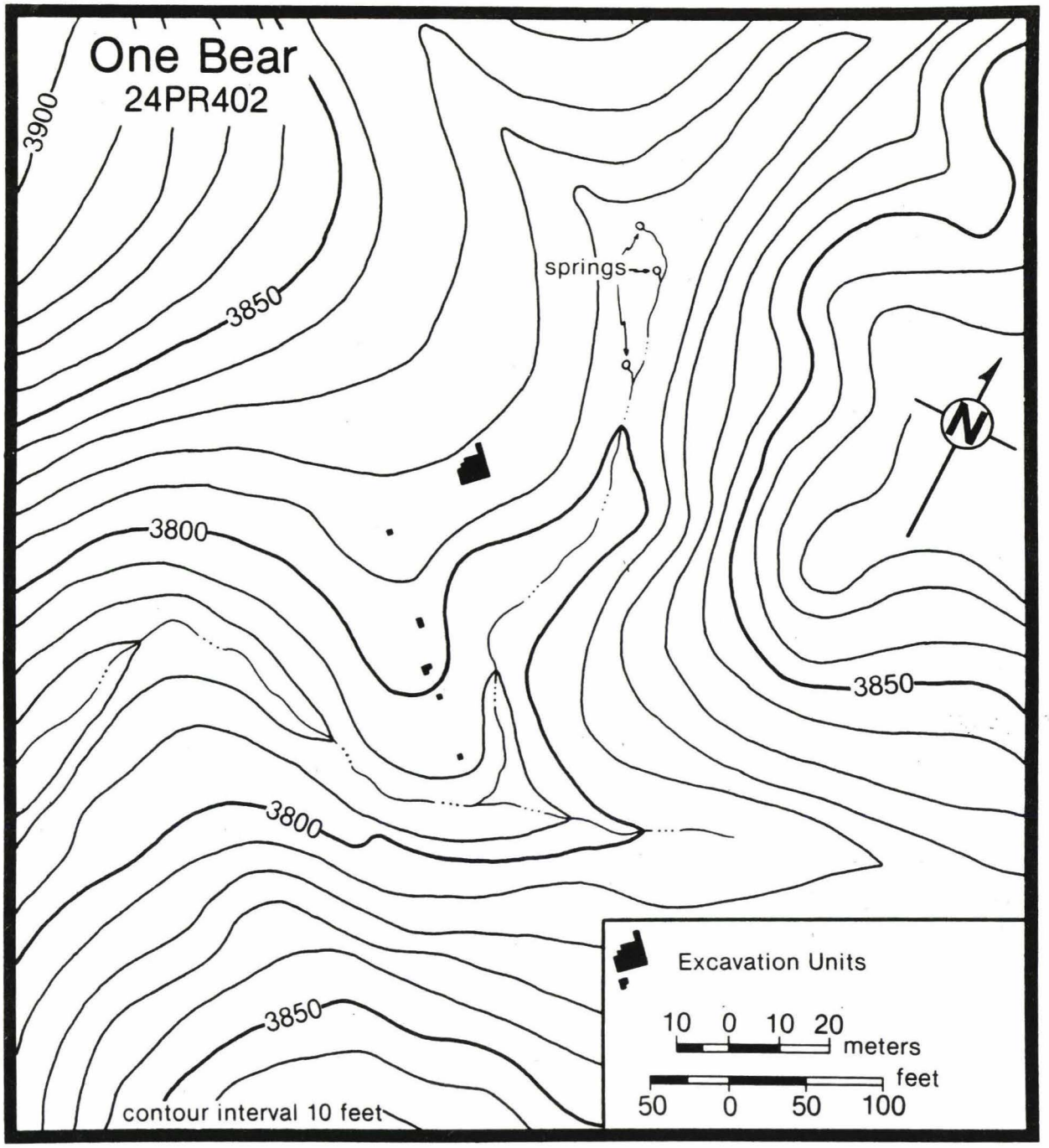

Fig. 21. One Bear site topographic map showing excavation units.

a few small rodent burrows. All cultural material except for that in the bottom of one fire basin was recovered from this stratum. Underlying the brown loam was a hard, compact yellowish-gray sandy clay alluvium. A deep test pit in one corner of Excavation Unit 1 demonstrated that this stratum was culturally sterile to a depth of 40 cm. The only cultural materials recovered from this deposit occurred where the excavated fire basin had penetrated approximately 15 cm into the yellow-gray clay.

Although cultural material was recovered from throughout the brown loam, debitage density is greatest in the 10-20 cm level (below surface), and field observation demonstrated that the debitage was clustered between 8 and 15 cm. Furthermore, the two features originated at depths of 13 and 15 cm below surface. These observations indicate a single occupation on a surface that represents the approximate initiation of a period of soil building on the basal yellowish-gray alluvium.

Structural Features

Two structural features--a prepared firehearth and a small, amorphous pile of burned and reddened sandstone slabs--were discovered at One Bear. The firehearth (Figs. 22, 23), located in the southeast corner of Excavation Unit 1 (Sq. J5, K5)[1], consisted of a shallow, round-bottomed, straight-sided pit that originated approximately 13 cm below ground surface. The oval pit, 48 cm in maximum diameter and 22 cm deep, was outlined by a thin rim of friable reddened soil between 2 and 3 cm thick. Pitfill consisted of ash and charcoal with a few tiny burned bone fragments and small chert and porcellanite flakes. Charcoal was concentrated near the bottom of the pit in what appeared to be a thick layer that had been disturbed in the center. The recovered charcoal

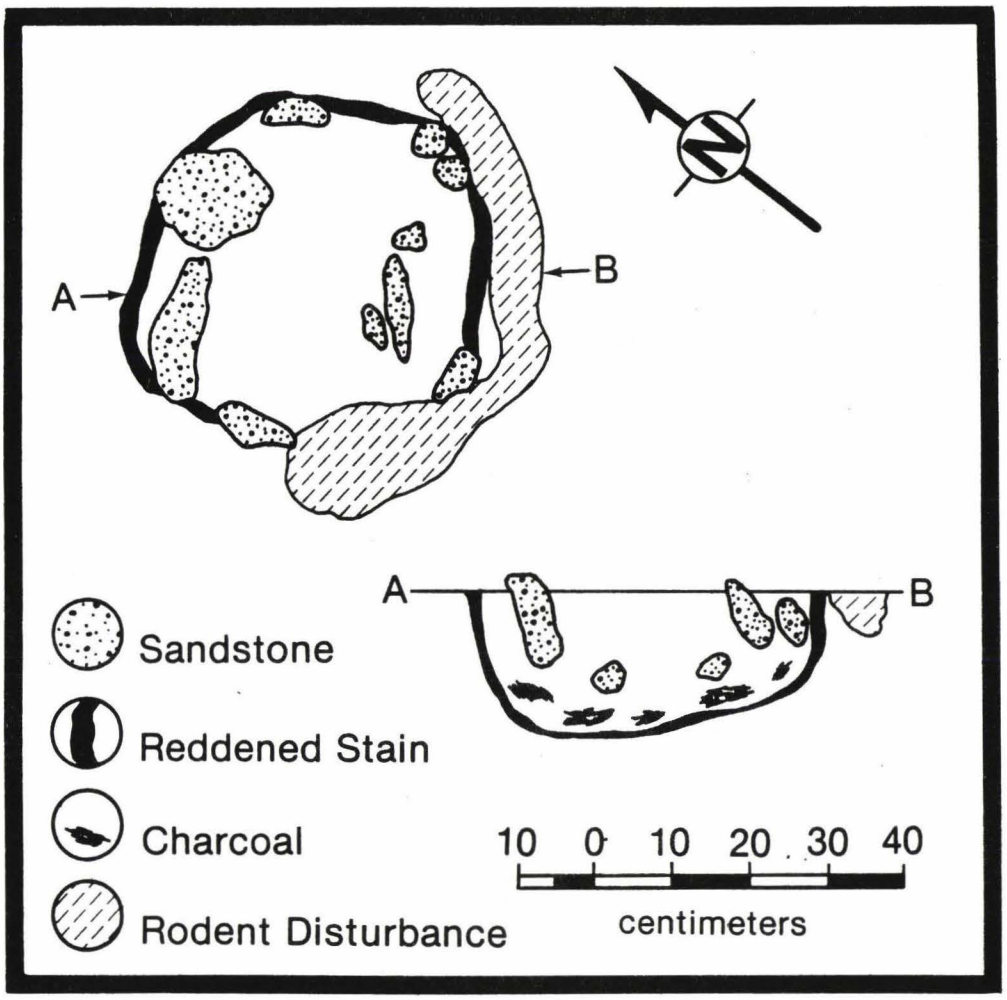

Fig. 22. One Bear site hearth, plan map and profile.

indicated that small limbs 2.5 to 4 cm in diameter had been used as fuel.

The hearth was "capped" by a layer of burned, reddened sandstone slabs that appeared to have been laid over the top of the pit with some slabs placed almost vertically around the inner edge of the pit mouth. The cap had been disturbed following construction and the central portion of this rock layer appeared to have been removed and partially displaced toward the north side of the basin so that the stones were casually piled two layers deep along the hearth's northeast side. Most of the vertically oriented peripheral stones had been only minimally displaced, but some had fallen slightly so that they sloped into the pit. If the cap ever completely covered the hearth, as it appears to have done based on the position and orientation of the remaining stones, some capstones were apparently taken elsewhere. This may help explain the small pile of fire-reddened sandstone 3.5 m north of this hearth. Beneath one of the remaining slabs we located small unburned bone splinters that appear to have been intentionally placed there after the fire had died.

The second feature was a small pile of burned sandstone slabs situated in Square G6, just outside Excavation Unit 1 and only 3.5 m north of the hearth. It was exposed during construction of the dam that now forms Yonkee Reservoir. The feature consisted of 22 sandstone slabs and chunks loosely stacked into an oval pile measuring 25 cm by 22 cm. Some pieces are overlapped three stones deep. The largest slab was displaced 10 cm west of the main pile, but it could not be determined if this was a result of the heavy machinery that uncovered the feature. Stones in the pile range from large slabs 10 to 12 cm across and 4 to 5 cm thick, to angular chunks 6 to 8 cm in size.

Fig. 23. Hearth at One Bear site. Note "stacking" of cobbles in background. Trowel points northwest.

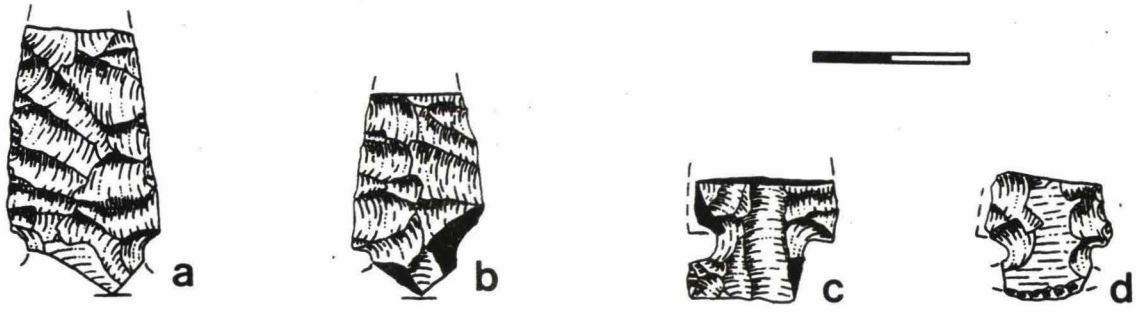

Fig. 24. One Bear site projectile points. Scale bar is 2 cm.

Small charcoal flecks were noted in two places between stones, and the matrix in the pile was slightly darker than the surrounding soil. The configuration of this pile was so similar to the caprock on the hearth that we first thought it represented a second hearth. However, the paucity of associated ash and charcoal, the lack of burned earth and the absence of an excavated pit indicate that it was not a primary fire feature.

The complementary nature of the two features and their proximity suggest that they represent a single thermal event, the nature of which was something like the following: Apparently the firehearth was a roasting pit for meat, and probably vegetal foods. Small limbs placed at the bottom of the pit provided heat, and stones were placed atop the pit and around the upper margin for heat entrapment and reflection. Sandstone chunks were probably also included with the food between the fuel and capstones. This configuration closely resembles an unopened roasting pit discovered at the Avocet site near Havre, Montana (Keyser 1979a:31-32). When the food was cooked, the cap of stones was partially removed to obtain the contents. This disturbed the charcoal in the bottom of the basin. Some capstones were displaced and stacked along the pit rim and others collapsed slightly into the opened interior, but many of the capstones and the chunks from the pit's interior were carried about 4 m north of the hearth and stacked loosely in a small pile. The function of this second pile cannot be demonstrated, but the distance from the hearth and careful placement of the stones suggest a deliberate action. A likely possibility is that the pile was used as a heat radiator. Following use of the firepit, several small bone splinters were placed underneath one capstone. Their function is unexplained, but a

similar situation occurred in a tipi ring firehearth at the Teton Ridge site northwest of Great Falls, Montana (Sharrock and Keyser 1975:152). The careful placement of these objects suggests perhaps ritual significance.

Artifacts

Some 8,133 chipped stone elements, a pecked anvil stone, and small amounts of burned and unburned bone scrap compose the artifact assemblage recovered from the One Bear site.

Chipped Stone Tools

Some 126 tool elements were identified on 120 discrete chipped stone artifacts from One Bear. Of these, 115 were recovered from our excavations, and 11 were surface finds. Recovered chipped stone tools include: projectile points, biface blades, bifaces, endscrapers, sidescrapers, utilized flakes, flake geometrics, notches, drill, burin, and discoid.

Projectile Points. Five broken projectile points (Fig. 24) were found at the One Bear site. Two specimens are large side-notched bases; two are midsections broken across the notches and at the tips; and one is an elongate blade fragment with intact tip. Workmanship is generally good, with broad, shallow flake scars. Bases are thinned and heavily ground. Neck widths of the three measurable specimens are 10.5, 12, and 15 mm.

In order to determine whether these projectile points were arrow points or dart points, we compared their morphological attributes to classificatory indices of neck width, weight, and overall size that have been derived from a large sample of Pine Parklands region projectile points (Keyser and Knight n.d.). The results of this analysis show that the One Bear projectile points are within the lower reaches of the ranges

of dart points in all attributes. Identification of these as dart points is also consistent with the recently published results of a neck width study on Northwestern Plains projectile points (Fawcett and Kornfeld 1980).

Biface Blades. Some 24 biface blades (Fig. 25a-d) were recovered. These tools are bifacially flaked over both faces and have acute edge angles (24°-60°) in combination with fine pressure retouch of the working edges. All but a single specimen are broken fragments. Most are bases or midsections of elongate, ovoid knives, but six are small tips, some of which may be projectile point fragments. The larger fragments show edge abrasion and polish. Much of this is probably use wear, but on the basal fragments it may be deliberate dulling to facilitate hafting. The morphology of these implements, coupled with their acute edge angles and breakage pattern, indicates that they were used for heavy duty cutting tasks.

Bifaces. Three large, thick, bifacially flaked tools with no appreciable marginal pressure retouch are classified as bifaces. All are made of porcellanite and show use abrasion on their sturdy working edges. Edge angles range from 78° to 81°, considerably greater than biface blades. Their robust form, edge wear, and characteristic edge angle indicate that they served as heavy duty cutting or chopping implements, probably for working hard materials such as wood or bone (Wilmsen 1972).

Endscrapers. Seven plano-convex endscrapers (Fig. 25e) were found. All are made on thick percussion flakes and exhibit steeply-bevelled, unifacially flaked working edges. Four specimens are of chert and show regular triangular shapes and better, more careful workmanship than the three porcellanite endscrapers. Most of these tools are heavily abraded

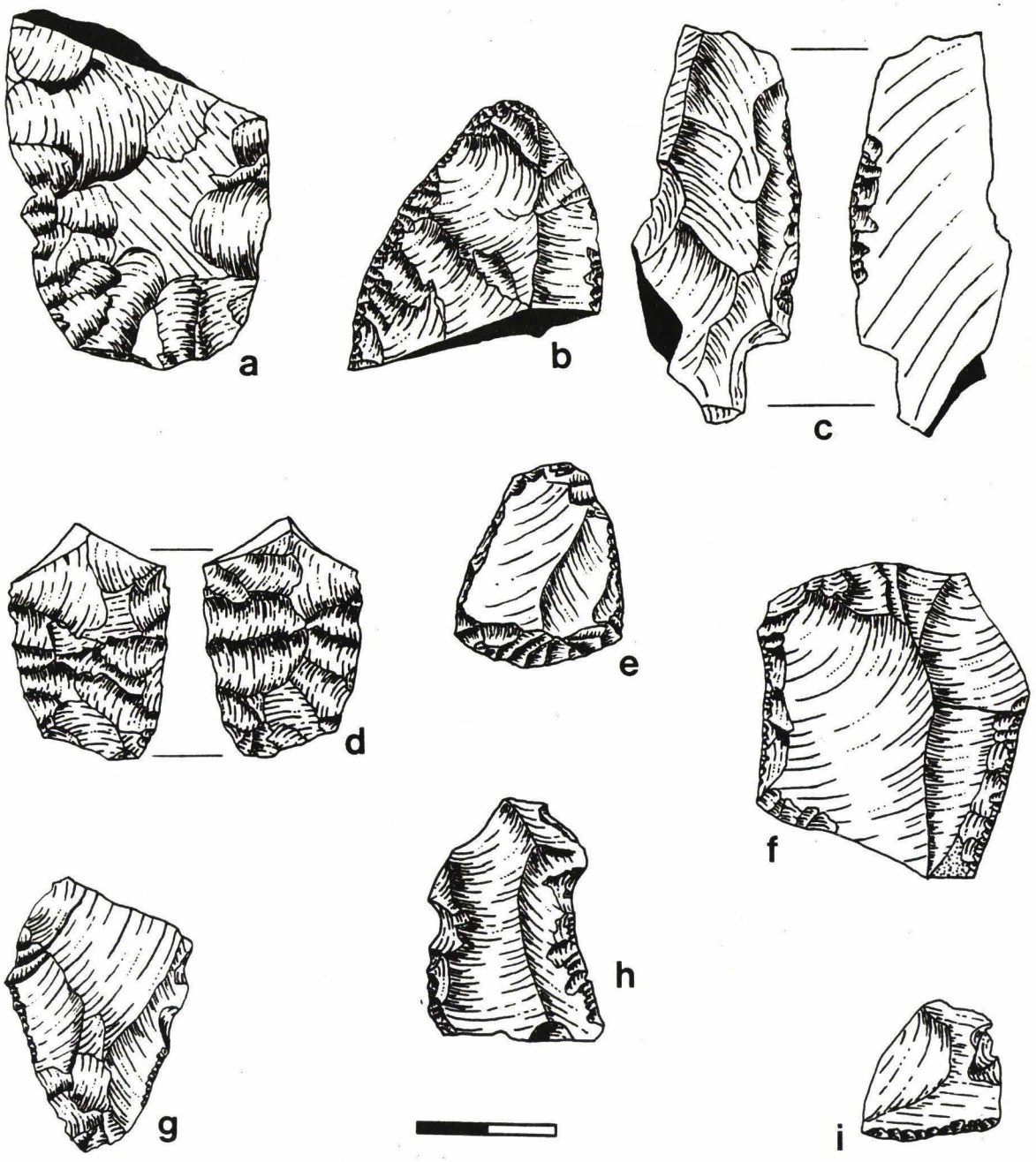

Fig. 25. One Bear site tools: a, biface; b-d, biface blades; e, endscraper; f, sidescraper; g-i, utilized flakes. Scale bar is 2 cm (note that i is 1.5 times scale).

and polished on the working edges in addition to step fracturing indicative of intensive use. The lateral edges of two endscrapers show a few bifacial attrition flakes, but no specimen has the bifacially worked lateral edge noted on three specimens from the Highwalker site.

Sidescrapers. Some 13 tools are sidescrapers (Fig. 25f). They show considerable variation in shape and size, but all have carefully flaked edges that contrast to the casually modified working edges characteristic of utilized flakes. Most sidescrapers are flaked over their entire dorsal surface, and all have fine, relatively steep (45^{o}-85^{o}) working edges. The majority of these implements are made of porcellanite, and most are unbroken. Edge use modification ranges from moderate to heavy abrasion and polish. The wide range of edge angles indicates use in a variety of scraping tasks involving both soft and hard materials (Wilmsen 1972:202).

Utilized Flakes. A total of 60 specimens (Fig. 25g-i) are classified as utilized flakes. As is the case with the Highwalker site tool assemblage, no distinction is made between deliberately retouched flakes and those that show only edge crushing and attrition from use, since morphological parameters are often hazy and functional implications are unclear.

Utilized flakes are made predominantly of porcellanite and show a variety of shapes and sizes. On most specimens the flaking or attrition scarring is predominantly unifacial, but a few show bifacial flake scars. Edge angles, measured on the most intensively used working edge of each flake, range from 20^{o} to 60^{o}, implying that they functioned in a wide variety of light-duty cutting and scraping tasks.

Flake Geometrics. Seven flake geometrics and a single "snap-break" tool on the broken end of a biface blade fragment were recovered from the One Bear site. As described in the Highwalker site discussion, these are small geometric pieces purposefully broken from larger flakes to produce steep (80^{o}-90^{o}) snaps that form durable working edges (Bonnichsen 1968; Crabtree 1977).

The One Bear specimens show a variety of triangular to trapezoidal shapes. Microscopic examination showed minimal use wear in the form of slight dulling and small attrition scars on the snap edges, but extensive use wear is not characteristic of these tools, since the working edges are so tough (Bonnichsen 1968). Five flake geometrics also have utilized edges other than the snaps that are classified as utilized flakes. One flake geometric (Fig. 26) was partially reassembled with the unused flake fragments, and clearly shows the breakage and use wear patterns characteristic of these tools.

One snapped edge made on a biface blade fragment (Fig. 25d) apparently functioned in a manner similar to flake geometrics. The snap was produced by two distinct blows--one to the ventral surface, and the other to the dorsal surface of the blade--that resulted in an obtuse angle snap with working edges showing 80^{o} and 100^{o} edge angles. As on flake geometrics, edge wear is limited to slight dulling and polish. Although made on a broken biface blade, it is classified here because of its morphological and apparent functional similarities to flake geometrics.

Notched Pieces. Three large porcellanite flakes have deep crescentic notches chipped in one edge by fine, unifacial pressure retouch. All three notches are between 12 and 14 mm wide and 3 to 4 mm deep, implying that they were used in the same task--perhaps for planing wooden projectile

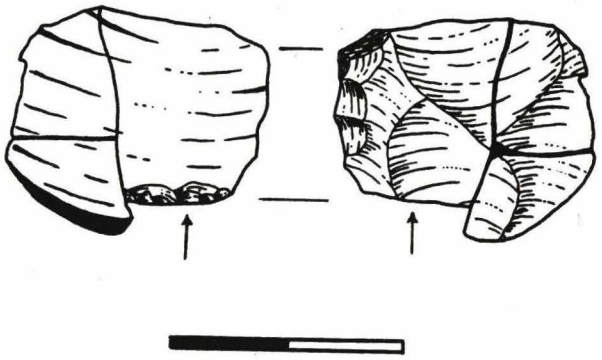

Fig. 26. Flake geometric (arrows indicate working edge with attrition wear) reassembled with unused fragments of original flake. Scale bar is 2 cm.

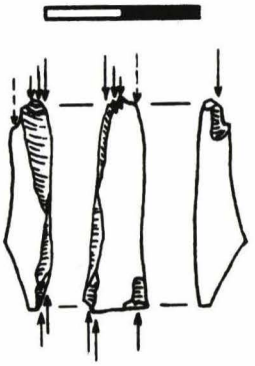

Fig. 27. One Bear site burin. Arrows indicate burin scars. Those at bottom may have served to dull tool for hafting. Scale bar is 2 cm.

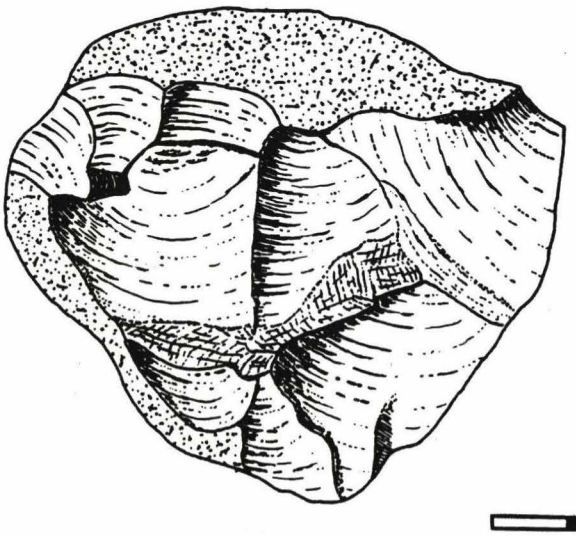

Fig. 28. Porcellanite core from One Bear site. Stippling indicates cortex. Scale bar is 2 cm.

shafts. The similarity between the width of these notches and the projectile point neck width supports this inference.

Drill. A single broken drill bit, manufactured from grey porcellanite, is approximately 2 cm long and 10 mm wide at the broken proximal end. The sturdy bit has a thick, lenticular cross section with heavily dulled sides and tip. No wear striations are observable because of a light calcium carbonate encrustation, but the heavy edge wear and dulled tip suggest use on wood, bone, or some other tough material.

Burin. A single thick, elongate, purple porcellanite flake was used as a burin (Fig. 27). The narrow flake is 27 mm long, rectangular in cross section, and appears to have been produced by a "snap" process much like that used to manufacture flake geometrics. Overall, the tool is very sturdy. One face of the specimen shows a single burin scar, and the smaller end shows extreme step fracturing that resulted from heavy use or resharpening. The size, shape, and evidence of heavy use on the tool imply that it was hafted into a bone or wooden handle for use on durable material.

Discoid. A fist-sized, ovoid discoid was found on the eroded terrace slope below Excavation Unit 1. The purple porcellanite implement is crudely bifacially worked around its entire margin with large shallow percussion flake scars. No pressure retouch is evident. Cortex is evident on one face, and a light calcium carbonate crust covers most of the other face. The entire margin of the tool is heavily ground and dulled, and in some areas shows evidence of battering. It could not be determined if the discoid was intended to be a core and the edge grinding was for preparation of the striking platform, or if the edge wear was due to use of the tool as a hand-held hammerstone. Porcellanite is

quite brittle and hence would probably not have been used as a hard-hammer percussion flaking tool, but it would have served quite well to pound wood, bark, or other vegetal fibers or to grain hides.

Tool Analysis

Lengths and widths of the unbroken chipped stone tools from the One Bear site were measured (Table 1). This analysis shows that unpatterned tools (utilized flakes) are markedly smaller than patterned tools. The overlap (Fig. 29) between the largest debitage elements and tools, however, shows that both patterned and unpatterned tools could have been produced from the largest debitage at the site. This supports the limited tool making inferred from the few cores and cortex flakes found at the site.

Like the size differences noted between the Highwalker and One Bear site debitage, the relatively large size of the late Archaic period One Bear tools may assist in the establishment of a general regional chronology when lithic assemblages from a full range of well-dated sites are analyzed.

Tool density (Table 2) is moderately high at One Bear, reflecting the large proportion of utilized flakes in the site assemblage and the relatively restricted occupation area with dense artifact clusters representing activity loci. Even so, tool density is similar to the Highwalker site as well as transitory campsites on the Southern Plains (Henry 1977a), suggesting that One Bear also served as a transitory encampment.

Lithic Debitage

Some 8,013 lithic debitage elements were recovered from the excavation of the One Bear site. More than 90 percent of the sample was

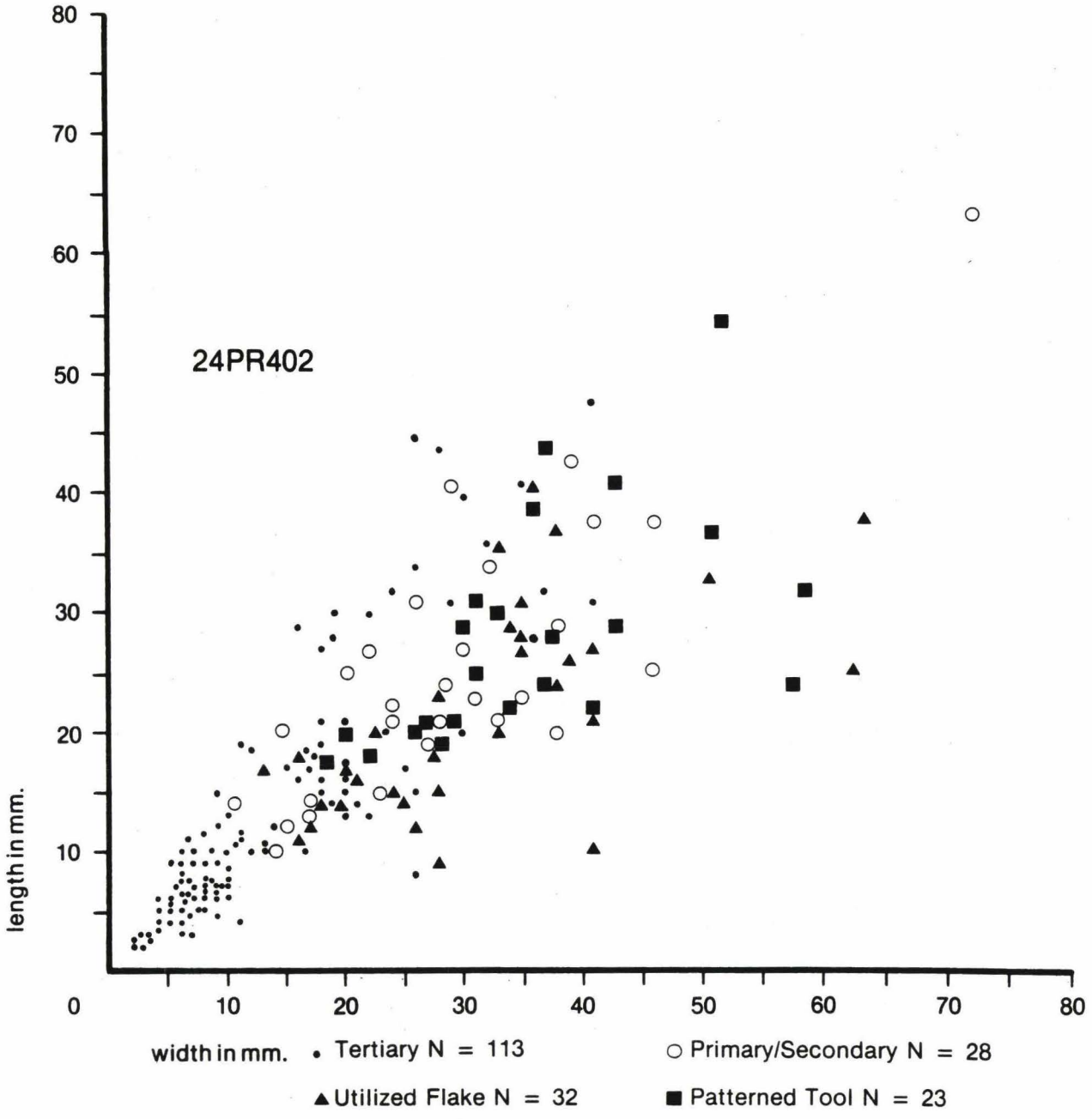

Fig. 29. Length-width scattergram of tools and debitage from One Bear site.

recovered from Excavation Unit 1. The site debitage is composed primarily of tertiary flakes with small quantities of primary, secondary, and biface thinning flakes. Six cores (Fig. 28) were also recovered.

Production Sequence

The high frequency of tertiary elements (Table 3) indicates that the final processing and maintenance of stone tools was the focus of the lithic industry at One Bear, but the presence of all types of debitage and cores indicates a full range of lithic processing activities. The limited numbers of cores, primary, and secondary elements coupled with the similarity of their distribution to that of tertiary flakes suggests that quarrying of the local porcellanite outcrop and subsequent tool manufacture was a casual activity that was of secondary importance to the ongoing routine of tool maintenance and rejuvenation. The occurrence throughout the Tongue River uplands of many such casually used porcellanite outcrops, coupled with the relative scarcity of major quarry workshop sites, suggests that this pattern of lithic exploitation is characteristic of the area. This pattern, due in large part to the ubiquitous occurrence of porcellanite throughout the region, is in direct contrast to other areas of the Northwestern Plains (e.g., the Knife River Valley, the Bighorn Mountains) where extensive open-pit quarries indicate planned, deliberate, direct procurement of lithic raw materials (Francis 1979; Clayton et al. 1970).

Size Analysis

Maximum lengths and widths of all unbroken spalls from the One Bear site were measured (Table 11). The average size of porcellanite flakes is greater than the average sizes of chert, quartzite, and fused glass debitage elements. As at the Highwalker site this apparently reflects

TABLE 10

Radiocarbon Dates

Sample Number	Site	Material	Radiocarbon Years BP*	Calendar Date*
Tx-3691	Highwalker	Charcoal	907±51	A.D. 1043±51
Tx-3984	Highwalker	Bone	1065±304	A.D. 885±304
Tx-3690	One Bear	Charcoal	1240±65	A.D. 710±65

*Dates calculated from A.D. 1950, corrected according to Damon et al. 1974.

TABLE 11

Metric Attributes of One Bear Site Debitage

	N	Length $\bar{X}$	SD	Width $\bar{X}$	SD
Chert					
Secondary	6	16.00	10.95	12.76	5.63
Tertiary	189	6.46	4.23	5.70	2.95
Biface Thinning	12	7.29	3.76	6.37	3.68
Porcellanite					
Primary	14	21.71	18.27	22.21	15.30
Secondary	35	21.46	10.89	20.56	9.37
Tertiary	599	7.47	6.26	7.43	6.56
Biface Thinning	45	7.49	3.68	7.43	4.84
Quartzite					
Tertiary	14	4.86	2.97	5.36	2.93
Fused Glass					
Tertiary	50	4.98	2.71	4.7	2.67

conservation of the scarcer raw materials, coupled with less concern for the more easily obtainable porcellanite.

Overall, the debitage from One Bear is markedly larger than that from the Highwalker site. For porcellanite there is the greatest distinction and this can probably be explained in part by the quarrying activities and proximity of a raw material source to the One Bear site which would have alleviated any need for conservation of this material. However, this situation does not explain the differences noted for chert, quartzite, and fused glass. We suggest that this size difference may reflect the larger tools characteristic of Archaic period assemblages, and if so, that debitage size may have some relevance in the establishment of relative chronologies.

Raw Material Types

The same classes of lithic materials were recovered from the One Bear site as occurred at Highwalker, although in markedly different proportions. Porcellanite was even more common at One Bear than at Highwalker, composing 76 percent of the lithic sample (Table 3). Chert accounted for approximately 16 percent of the sample and there were small quantities of fused glass and quartzite. In addition, six obsidian flakes and two basalt flakes were recovered. An interesting contrast to the Highwalker site lithic assemblage is the presence at One Bear of nearly twice as much fused glass as quartzite.

The preponderance of porcellanite at One Bear indicates that the site occupants relied on local lithic materials to a greater extent than those living at Highwalker--a fact reinforced by the One Bear site occupants' exploitation of the marginal porcellanite source at the site. It is possible that this reliance on porcellanite represents a site

specific or seasonal variation, but other factors suggest that it may, in fact, reflect a more localized focus of lithic procurement. One of these is the composition of the chert sample. Most varieties of chert are those that could be obtained in gravel deposits along the Tongue, Powder, and Yellowstone Rivers, rather than cherts such as Knife River Flint, phosphoria chert, and other materials that would involve long distance trade or travel to obtain. Further support for our inference of a more localized lithic procurement system is provided by examination of the cortical surfaces on primary and secondary elements from the site. The cortex indicates that porcellanite was obtained from primary bedrock sources but, in contrast, that most chert was obtained from derived river gravel sources. River gravels provide the only locally available chert sources in the Pine Parklands region.

Load Application Analysis

Load application analysis was conducted on the One Bear site debitage in the same manner as described for the Highwalker site (see above). The results of this analysis (Table 6) show that the One Bear debitage is composed of significantly larger and heavier flakes than the debitage from Highwalker. Furthermore, the mean thickness and weight of the One Bear tertiary elements is more like experimentally produced soft-hammer percussion flakes than pressure flakes. This suggests a greater emphasis on percussion flaking at the One Bear site, an observation consistent with the evidence for quarrying and the initial stages of tool manufacture at the site.

Debitage Density

Debitage density (Table 2) at One Bear was markedly greater in the area of Excavation Unit 1. Apparently the southern edge of the site,

where the test pits were dug, was peripheral to the main occupation. In both areas, however, debitage density is slightly greater in the 10-20 cm level, supporting our field observation that material was concentrated between approximately 8 and 15 cm deep. The overall debitage density is comparable to, although just slightly higher than, that characteristic of transitory encampments in the southern plains (Keyser and Farley 1979:62; Henry 1978:92). Unfortunately, no directly comparable data are available from the Northern Plains. The casual exploitation of the local porcellanite outcrop and the subsequent limited tool manufacture, may be partially responsible for the slightly greater-than-expected debitage density. Investigation of other transitory campsites in this region may clarify this situation.

Tool-to-Debitage Ratio

The tool-to-debitage ratio at the One Bear site is very high (Table 2), indicating a limited amount of lithic processing activities. In conjunction with the frequency of tertiary and secondary elements, this analysis indicates that the lithic industry was focused on the maintenance of existing tools with an important, but secondary emphasis on the initial stages of tool manufacture as indicated by the recovered cores and primary and secondary elements. The paucity of biface thinning flakes indicates that there was little rejuvenation or secondary manufacture of biface blade tools. This suggests that "tool blanks" produced by the quarrying and decortication activities conducted at the site were carried elsewhere before they were refined into tools.

As with the debitage density, the tool-to-debitage ratio is very similar to that characteristic of transitory campsites in the Southern Plains (Keyser and Farley 1979:61-62; Henry 1977b:128, 1978:92).

Ground Stone

A small metamorphosed shale slab that had been used as an anvil stone was located adjacent to the hearth in Excavation Unit 1. The tabular stone measures 16 cm long, 20 cm wide, and 7 cm thick. Its ventral surface is flat; the dorsal surface is a shallow, slightly pitted basin. Margins on the dorsal surface are battered. This anvil could have served several purposes, but its placement in the site and wear pattern suggest that it was a platform on which to crush bone for grease extraction or on which to process vegetable foods.

Bone Debris

A total of 141.66 gm of bone and tooth enamel fragments was recovered from the One Bear site, almost all of which was found in Excavation Unit 1. Recovered bone included both burned and unburned specimens. All bone was broken into small pieces, more than 67 percent of which are less than 1.5 cm in size. Only two fragments are identifiable even as to element. One is the distal end of a ground squirrel humerus and the other is a small skull fragment from a dog- to deer-sized mammal. Several other small, burned, longbone shaft fragments represent ground squirrels or similarly sized animals, and a few larger bone chips are gracile longbone splinters that appear to represent a deer sized animal. No recovered bone appeared large enough to be from a bison. No worked bone was recovered.

Analysis of the recovered bone shows that it is approximately equally divided between burned and unburned specimens (Table 8), but that 95 percent of the burned bone consists of fragments less than 13 mm in size. In contrast, more than 60 percent of the unburned bone fragments are larger than 13 mm. Much of the burned One Bear bone is only

lightly charred and many fragments are only partly burned. As at Highwalker, it appears that this burning was done after the bone was broken, and the cluster of crushed bone around the firehearth suggests bone marrow extraction and grease production. The limited amount of bone, however, indicates that this was on a much smaller scale than at the Highwalker site, and coupled with the type of burning this implies that the burned bone resulted from charring a small amount of cooked meat or "bone gruel" being processed for grease. The predominance of small, partially burned fragments supports the latter interpretation.

The paucity of bone recovered from the One Bear site indicates that big game hunting was not the focus of this occupation. Although bone preservation was generally good, less than 150 gm of bone was recovered. This total includes a few parts of one or two medium sized animals (dog, deer) that were butchered and eaten at the site, and burned bones representing ground squirrels that were killed and eaten. The limited amount of recovered bone implies some use of vegetal foods or preserved, processed meat products (pemmican, grease, jerky). This emphasis, coupled with the exploitation of gophers and other small game indicates a foraging type economy, at least seasonally, that is consistent with the site's late Archaic period date.

Distributional Analysis

As at Highwalker, we calculated density distributions in order to elucidate intrasite patterning of the artifacts at the One Bear site. The analysis was like that done for the Highwalker materials except that 50 cm square quadrants were utilized to provide finer horizontal control. Artifact patterns for the 0-10 cm and 10-20 cm levels were not significantly different, supporting our interpretation that the site represented

a single occupation. Hence, the entire 0-20 cm deposit is analyzed as a unit. As at Highwalker our efforts are focused on the large plaza--comprising 29 contiguous 1 m squares, since it forms an area in which differential densities would show areal patterning. Distribution of lithic debitage bone scrap, and chipped stone tools are analyzed.

Lithics

Nearly 92 percent of the recovered lithics was obtained from Excavation Unit 1, and the debitage density there was almost twice as great as in the test pits along the south edge of the site. Hence, it appears that the center of the open terrace was the focus of tool manufacture and maintenance efforts.

Three distinct clusters[2] of lithic debris (Fig. 30) were noted in Excavation Unit 1.

Cluster A is centered around square K4. It is a compact, moderately dense concentration of debitage, roughly circular in plan, with the prepared firehearth slightly off center to the northeast (square K5). The cluster measures approximately 3 m across.

Cluster B, centered on squares L7 and L8 in the southeast corner of the excavated plaza, appears to have been only partially exposed. The excavated portion is roughly ovoid in plan and shows a dense, compact concentration of flakes that directly abuts both the south and east walls of the excavation unit. Surrounding the exposed perimeter of the dense cluster is a series of quadrants with moderate flake densities. If this cluster extended approximately 1-2 m outside the excavated area to the south, southeast, and east (as the shape of the excavated portion suggests) it would have been roughly equal in size to cluster A.

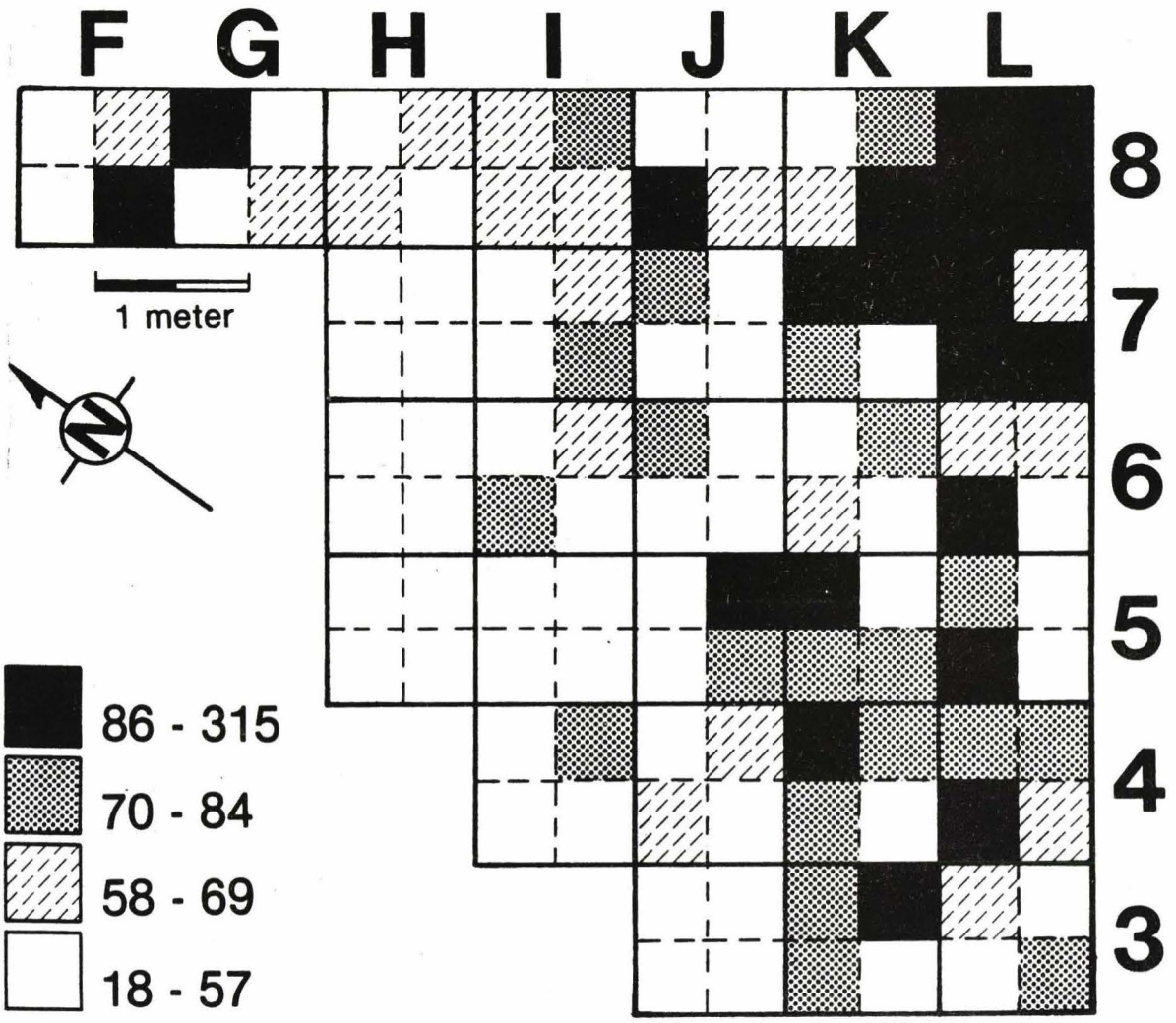

Fig. 30. Density distribution of lithic debitage at One Bear site. Shading represents numbers of lithic debitage elements.

Cluster C is a loose, crescent-shaped concentration of debitage between squares G8 and I7. Other than two quadrants on the north end of this cluster whose densities were skewed by the presence of several hundred tertiary pressure flakes of fused glass that probably represent the sharpening of a single tool, the density of cluster C is markedly less than the other clusters (Table 12).

Bone

A very small amount of relatively well preserved bone was recovered from the One Bear site. More than 98 percent of it was found in Excavation Unit 1, where it clustered in three groups (Fig. 31) that show approximately the same size, shape, and spatial arrangement as the lithic debitage clusters. Hence, for convenience we also label these clusters A, B, and C.

The bone clusters are composed of both burned and unburned fragments, which occur in the site in approximately equal amounts. Originally we calculated separate density distributions for burned and unburned bone debris, and although each did show the three-cluster pattern, it was somewhat obscured by the small samples and different ratios of burned-to-unburned bone in clusters B and C. Therefore, we depict only the overall density distribution because it shows the clustering most clearly. Table 13 displays the burned-to-unburned bone ratios in each cluster.

Cluster A shows the densest bone concentration. This is due to almost equal amounts of burned and unburned bone (Table 13), but it should be noted that more than two-thirds of the largest bone fragments (those greater than 1.5 cm in maximum dimension) were recovered from this cluster. Most of the larger bone fragments were unburned longbone

TABLE 12

Debitage Distribution by Cluster[2]

Debitage Class	Excavation Unit 1		Cluster A		Cluster B		Cluster C		Noncluster Quadrants	
	N	%	N	%	N	%	N	%	N	%
Core	6	0.1%	0	--	3	0.2%	2	0.1%	1	0.05%
Primary/ Secondary	161	2.2%	57	2.6%	33	2.2%	28	1.8%	43	2.1%
Tertiary	7092	96.4%	2106	95.8%	1477	96.8%	1516	97%	1993	96.3%
Biface Thinning	100	1.4%	35	1.6%	15	0.9%	17	1.1%	33	1.6%
Total	7359		2198		1528		1563		2070	
Debitage Density*	127		152		170		149		87	

*Density calculated as number per 0.1 cu. m

TABLE 13

Bone Distribution by Cluster[2]

Bone Class	Excavation Unit 1		Cluster A		Cluster B		Cluster C		Noncluster Quadrants	
	gm	%	gm	%	gm	%	gm	%	gm	%
Burned	73.35	52%	38.9	53%	12.25	68%	13.85	37%	8.35	74%
Unburned	66.65	48%	34.3	47%	5.85	32%	23.5	63%	3	26%
Total	140		73.2		18.1		37.35		11.35	
Bone Density*	2.4		4.1		2.4		3.6		0.5	

*Density calculated as grams per 0.1 cu. m

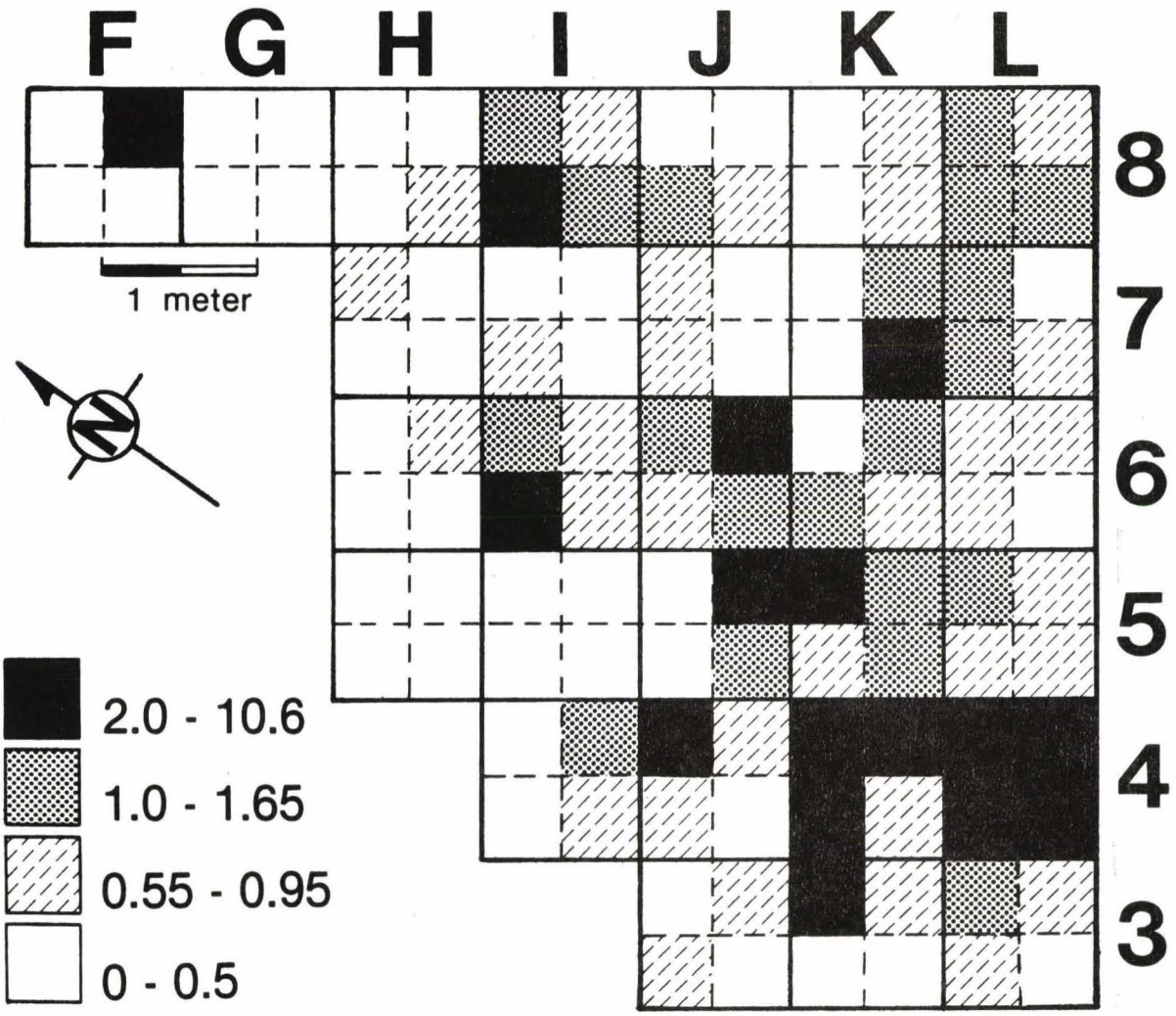

Fig. 31. Density distribution of bone debris at One Bear site. Shading represents weight of bone in grams. Burned and unburned bone combined in this distribution.

splinters lying just southwest of the hearth. Within cluster A, a minor, secondary concentration occurs to the northeast of the hearth, obscuring the definition of a sharp boundary between clusters A and C as was noted for the lithic debitage clusters. Finally, cluster A shows approximately the same size and relative density for both lithic debris and bone scrap.

Bone cluster B, like its counterpart lithic debitage cluster, is nestled in the southeast corner of the plaza and appears to have extended outside both the south and east edges of the excavation unit. It is only moderately dense and is composed primarily of small burned bone chips. Its lesser density and slightly smaller size contrast to lithic debitage cluster B.

Bone cluster C is slightly larger than lithic debitage cluster C, but it has approximately the same crescent shape and overall moderate, "patchy" density. In direct contrast to bone cluster B, the composition of this cluster is primarily unburned bone fragments. As was the case with the lithic debitage clusters, a distinct boundary separates bone clusters B and C.

Chipped Stone Tools

Of the 115 chipped stone tool elements recovered from our excavations at the One Bear site, 105 (91 percent) were from Excavation Unit 1. In this unit the tools are loosely grouped into the three clusters (Fig. 32) defined by lithic debitage and bone debris distributions, although the small sample size precludes as strong a pattern as was noted for the more numerous artifacts.

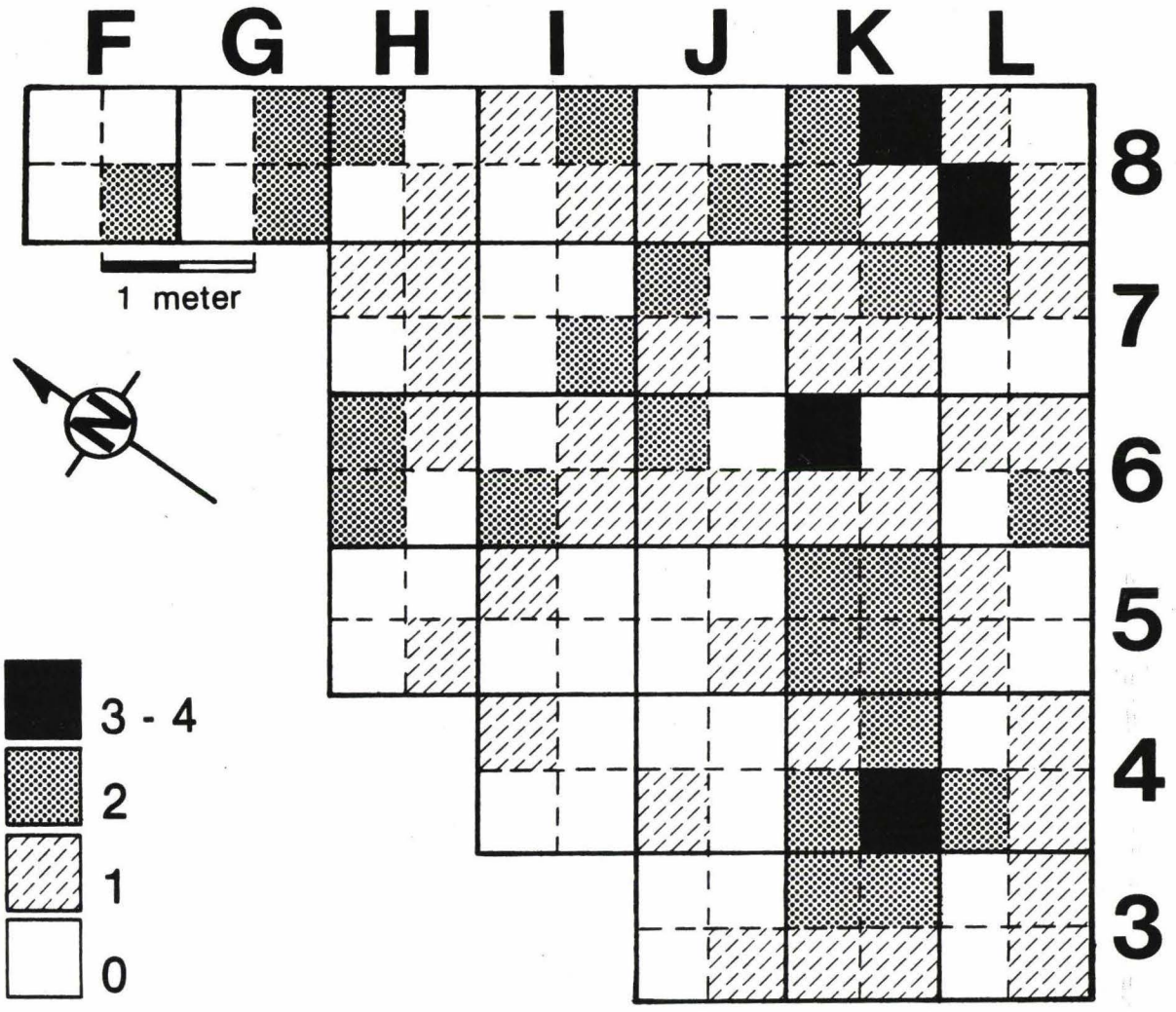

Fig. 32. Density distribution of tools at One Bear site. Shading represents number of tools. Patterned tools and utilized flakes combined in this distribution.

In the approximate center of cluster A, to the south and west of the hearth, there is a dense tool concentration composed primarily of utilized flakes and flake geometrics. A few scrapers and biface blades are scattered around this central group. This distribution suggests that nearly all of the tools in cluster A are associated with the hearth and bone concentration. Overall, however, the tool density for cluster A is low (Table 14).

In the southwest corner of Excavation Unit 1, biface blades and utilized flakes form a dense tool concentration along the northwestern margin of cluster B. Although few other tools are found in this area, the number of blades and utilized flakes in this restricted area produces a tool density (Table 14) that is markedly higher than in either other cluster.

Cluster C shows a light-density, patchy tool distribution with a wide variety of tools scattered across the crescent-shaped area. The low tool density within cluster C (Table 14) is almost the same as in cluster A, but this is the result of individual tools scattered about a slightly smaller area rather than a tool concentration such as that in cluster A.

Discussion

Given the three artifact clusters (Fig. 33) defined by the density distributions, further analysis is possible to determine the interrelationships of their component artifacts and thereby to understand the function and interrelationship of the clusters.

The clusters were defined partially on the basis of the total lithic sample; however, further analysis (Table 12) shows that each cluster consists of all types of debitage in very similar proportions.

TABLE 14

Tool Distribution by Cluster[2]

Tool Type	Excavation Unit 1 N	%	Cluster A N	%	Cluster B N	%	Cluster C N	%	Noncluster Quadrants N	%
Projectile Point	4	3.8%	0	--	1	4.3%	0	--	3	13.6%
Biface/ Biface Blade	21	20%	4	11.4%	7	30.4%	2	8%	8	36.4%
Scrapers	16	15.2%	6	17.1%	1	4.3%	7	28%	2	9.1%
Flake Geometric/ Utilized Flake	60	57.1%	25	71.4%	14	60.9%	12	48%	9	40.9%
Special Purpose	4	3.8%	0	--	0	--	4	16%	0	--
Total	105		35		23		25		22	
Tool Density*	1.82		1.84		2.55		1.79		1.40	
Tool/ Debitage Ratio	1:70		1:63		1:66		1:63		1:94	

*Density calculated as number per 0.1 cu. m

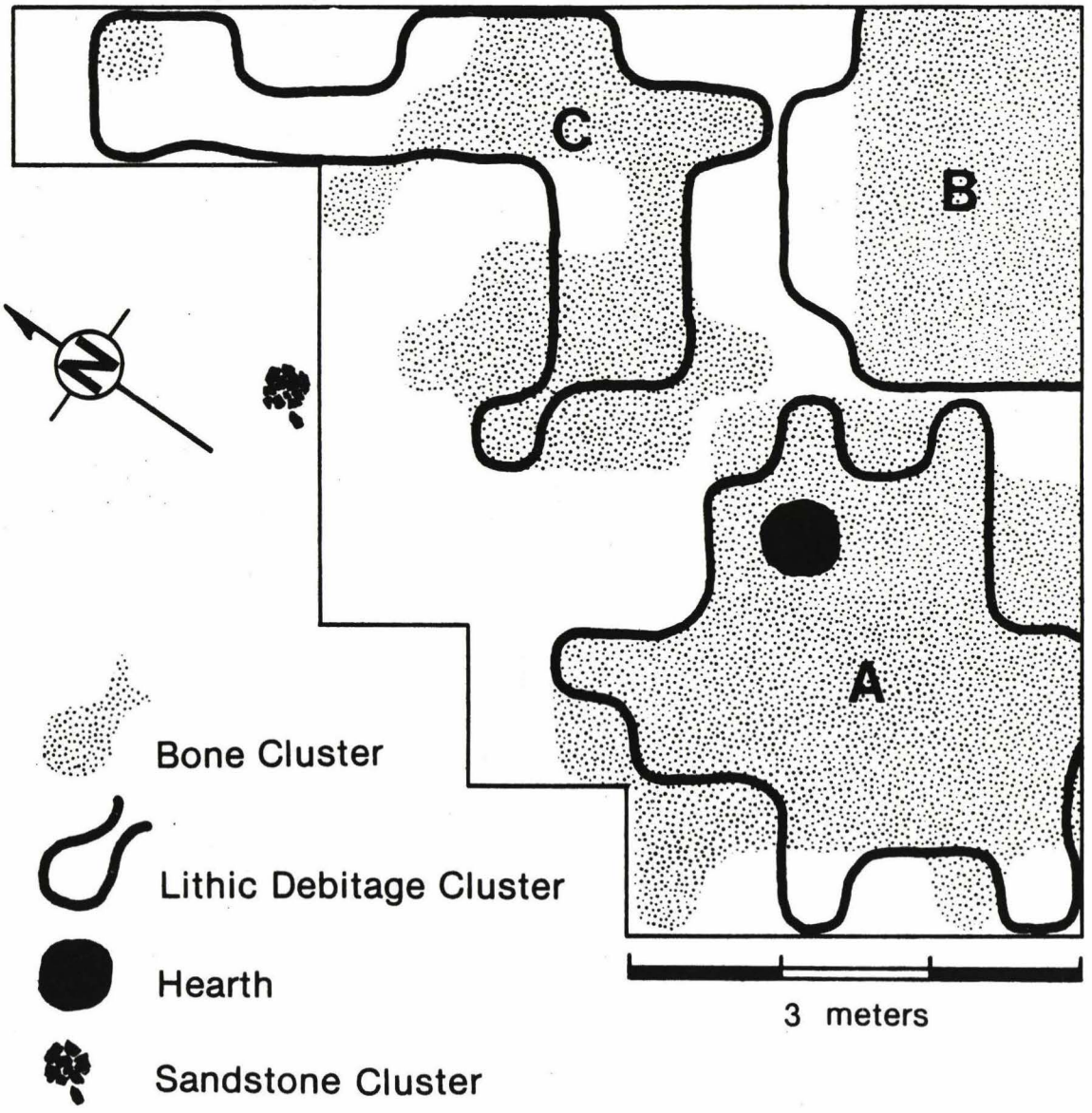

Fig. 33. Schematic distribution of artifact clusters and features at One Bear site. Letters designate artifact clusters.

Furthermore, the clusters each reflect approximately the same proportions of debitage classes as does the total site lithic sample. These data indicate that a full range of lithic processing activities occurred in each cluster, but that emphasis was on tool maintenance as reflected by the preponderance of tertiary flakes. Thus, from the standpoint of the lithic industry, each cluster was apparently independent, but cluster B reflects slightly more intensive activity as indicated by its greater debitage density.

In general, burned and unburned bone at the One Bear site show similar distributions, rather than the spatially distinct complementary distributions noted at Highwalker. On a more refined scale, however, it is apparent that only cluster A actually has nearly equal proportions of burned and unburned bone (Table 13). In cluster B burned bone is more than twice as abundant as unburned bone, and in cluster C approximately the reverse occurs. These data, coupled with the occurrence of relatively large bone fragments in each cluster, indicate that meat processing (stripping meat from bones as the final stage of butchering), bone crushing (to obtain marrow and produce grease), and burning (probably the result of charring meat or bone "soup") occurred around the hearth in cluster A as a spatially integrated sequence of complementary activities. Furthermore, since the only hearth was located in cluster A (the presence of other hearths is unlikely, given the careful monitoring of construction activities that exposed almost all of the site) the burned bone in clusters B and C indicates that both were dependent, to some extent, on cluster A. The different bone ratios, however, indicate that the emphasis in cluster C was on preliminary processing activities such as meat stripping and bone crushing, while in cluster B the emphasis was on using bone that had been cooked and burned.

Support for the apparent interdependence of these clusters is provided by examining the separate distributions of burned and unburned bone which provide some insight into the processes by which the bone scrap was deposited across the site. For instance, it is readily apparent that burned bone in both clusters B and C forms a continuous distribution with the concentration of burned bone around the hearth in cluster A. This supports the inference that cooking was done at the hearth and the by-products (burned bone) were returned to the other clusters for use and disposal. Unburned bone also showed a continuous distribution between clusters A and B, indicating that all the bone in cluster B had been derived from cluster A. On the other hand, there was a distinct, spatially segregated concentration of unburned bone in cluster C, indicating that butchering took place in both clusters A and C.

In an attempt to determine the interrelationships of the various tool classes at the One Bear site, we calculated tool associations like those done for the Highwalker site tool assemblage. These calculations, however, showed no significant intra-class associations, but rather showed both small, similar-strength positive and negative correlations between nearly all tool classes (e.g., θ of .30 for utilized flakes associated with biface blades, θ of .33 for utilized flakes not associated with biface blades). Thus, the θ values indicate the independence of each tool class across the entire site. Provenience data, however, indicated that tool types were congregated in specific clusters. Since these were not demonstrated by our initial analysis, we examined the composition of the cluster-specific tool kits in an attempt to determine the activities conducted within each cluster.

As indicated above, tool density was greatest in cluster B, and approximately equal in clusters A and C. The tool-to-debitage ratio was very similar in each cluster, however, and the cluster ratios were all similar to the overall site tool-to-debitage ratio. These data indicate that all three clusters are approximately equivalent in relative amount of tool manufacture and maintenance activities. Like the debitage composition (above), this implies the independence of each cluster.

Tool kit composition within each cluster was significantly different, indicating that different tasks were conducted in each area. Cluster A showed a predominance of utilized flakes, and only three of the five functional tool categories were represented (Table 14). As mentioned above, these utilized flakes were directly associated with the butchered bone clustered around the hearth, suggesting that they functioned primarily as light-duty cutting and scraping tools used in the butchering process, much like they did at the Highwalker site. The few biface blades in cluster A tended to be slightly spatially disassociated with utilized flakes which may imply that they functioned in different tasks. Supporting this inference is the experimental observation that flake tools are markedly more efficient than biface tools in butchering tasks (Walker 1978). Scrapers are present in cluster A in approximately the same proportion as throughout the entire excavation unit, indicating that scraping tasks were not overly emphasized here.

Tools in cluster B were almost exclusively utilized flakes and biface blades, most of which occur together in a concentration near the northeast boundary of the cluster. The utilized flakes occur in approximately the same proportion as throughout the excavation unit, but there is a markedly greater proportion of biface blade tools here than elsewhere

in the unit (the proportion would be even higher if two biface blades just outside the cluster boundary that appear to be associated with those within the cluster were included). The combination of utilized flakes and biface blades indicates a strong emphasis on cutting activities in this location, but these appear to have been heavy cutting tasks as indicated by the preponderance of biface blades and large, sturdy utilized flakes. Unlike cluster A, the cutting tools in cluster B are not found with the bone debris, implying that they were used in tasks other than butchering. Furthermore, in contrast to cluster A, the close association of biface blades and utilized flakes implies that the workers in cluster B used them either interchangeably or sequentially in closely related tasks. The presence of only a single sidescraper indicates that scraping tasks occurred rarely in cluster B.

Cluster C shows the most varied tool kit--one that includes at least one specimen of every tool class except projectile point and biface. Although utilized flakes compose nearly half of the assemblage, they are comparatively less common here than anywhere else in the site. Likewise, biface blades are less common here than elsewhere. On the other hand, scrapers occur more often in cluster C than anywhere else and all the special purpose tools from the excavation were found in this cluster. These various tool types indicate that a wide variety of tasks was performed here, in contrast to the limited range of activities that characterized clusters A and B. The utilized flakes are associated with the unburned bone (as in cluster A, although not as strongly) and indicate that they were primarily used as light-duty butchering tools. In addition, however, the scrapers, drill, burin, and notches indicate an emphasis in cluster C on secondary manufacturing tasks (e.g., hide-working,

tool repair, clothing manufacture or repair) that was not apparent in cluster A where the recovered tools indicated an overriding emphasis on primary food procurement and processing activities.

In summary, the clusters represent activity loci, each of which is the product of a slightly different set of tasks. Cluster A shows a limited range of chipped stone tools, most of which were used in butchering. The presence of the cooking hearth (shared with both other clusters) and the emphasis on butchering suggests a kitchen area where primary food processing, preparation, and consumption activities predominated. The lack of tools associated with manufacturing or maintenance activities (e.g., clothing manufacture, tool repair) supports this inference.

Cluster B appears to be related to cluster A. Small quantities of bone scrap apparently derived from cluster A indicate limited food consumption. This inference is consistent with the paucity of processing tools associated with the bone debris. Rather than a kitchen area, cluster B appears to be a workshop. Tools found there are predominantly biface blades and utilized flakes with edge angles that cluster between 35° and 45°, a range that appears best suited to the heavy cutting tasks involved in wood and hide working (Wilmsen 1972:202). Support for the workshop designation is provided by the high density of both tools and debitage that indicates extensive tool maintenance and rejuvenation as the result of intensive cutting and sawing activities.

Cluster C shows an almost full range of activities, and with the exception of the reliance on the cooking hearth in cluster A, appears nearly self-contained. A concentration of butchered bone with a few associated utilized flakes indicates meat processing, although to a

slightly lesser extent than Cluster A. Cooking, however, was apparently done at the hearth in Cluster A, but the burned bone distribution indicates that some (possibly all) of the cooked meat and bone was returned to cluster C. In addition to the food processing and consumption, the varied tool kit indicates that a variety of workshop tasks were also conducted in cluster C. Some utilized flakes appear to have been butchering tools, but others, coupled with the biface blades, scrapers, drill, burin, and notched tools indicate extensive hide- and woodworking, probably to manufacture or maintain perishable items such as clothing and wooden implements that left no trace in the site deposit.

Inferences and Interpretations

Analysis of the data from One Bear enables some tentative interpretations concerning the cultural-historical affiliation, seasonality and utilization of the site, and the demographics of its occupants.

Chronology

A single radiocarbon date was obtained on charcoal from the firehearth exposed in Excavation Unit 1 at the One Bear site. The corrected date (Table 10) of 1240±65 B.P. (Tx-3690) yields an age of A.D. 710±65. This date is consistent with the projectile points recovered from the site which are relatively small, gracile dart points similar to those recovered from level III of the Kobold site (Frison 1970a:15-17).

Given this age, and the association of dart points, it appears that the site represents a Late Plains Archaic period occupation. Small side- and corner-notched dart points similar to the One Bear specimens have been recovered from other Late Archaic period sites in this area (Fredlund 1973:35-36, 49; Frison 1970a), and radiocarbon dates indicate that the Archaic period lasted until approximately A.D. 750 in this area of the Northwestern Plains (Frison 1978:56-62).

Site Seasonality

Seasonal use of the One Bear site cannot be definitely determined because the recovered evidence is so fragmentary and incomplete, but some tentative suggestions are possible. Winter use seems unlikely since the canyon bottom would be shaded all day long and the canyon mouth is subject to considerable snowdrifting. Personal experience indicates that open terraces below south-facing bluffs are the warmest areas for late fall, winter and early spring occupation--an observation supported by settlement patterns characteristic of several areas within the Pine Parkland region (Davis 1980; Keyser 1979b). Summer use also seems unlikely since the canyon traps heat, and is sheltered from the cooling evening breezes characteristic of the area. These factors caused the authors to camp at the canyon mouth during the July and August excavation season, and the presence of site 24PR626 on the edge of the open plateau above Yonkee Spring indicates that prehistoric groups utilizing this area also sought the more exposed areas during some seasons.

The small pile of stones near cluster C was apparently a heat radiator, possibly used in conjunction with a small structure. The use of this rockpile implies that the site was occupied during a season when the weather was cold enough to necessitate a heated tent, but yet mild enough not to require a live fire. Personal experience has shown that such a heating system would be necessary during spring and fall and probably also some summer evenings. It would be inadequate during normal winter weather from November through March.

Food resources utilized at the site also provide some clues as to seasonality. The exploited faunal resources would have been available

nearly year-round, except for ground squirrels which hibernate during the winter season. Hence, use of ground squirrels suggests other than winter season use. As mentioned above, the limited quantity of bone suggests some vegetal food utilization. The absence of manos and grinding slabs is negative evidence for use of the site during summer and early fall when grasses and other plant foods that require milling would have been exploited. Other late Archaic period sites in the region often have grinding stones (Frison 1978:352-355), indicating the use of grass seeds when available. The hearth, however, has some characteristics of a root roasting pit (see Wright, et al. 1980:190) and may have been used to cook bulbs or roots from plants such as wild onion (Allium), wild carrot (Lomatium), smartweed (Polygonum), Indian potato (Lupinus), cattail (Typha), or bullrush (Scirpus). According to Robert Hamner, Forest Service range ecologist and former District Ranger on the Custer National Forest, these are the most common root plants in the general site area, and they would have been available during the period between April and July (personal communication, 1981).

In summary then, although no time of year can positively be ruled out, a constellation of factors suggests that occupation at One Bear is most likely to have occurred in the spring and early summer period during the months of April, May, or June.

Site Utilization

The artifacts recovered from One Bear, coupled with their intrasite patterning, provide some detailed insights into the function of this occupation. Stratigraphically, the site is a shallowly buried, single component. The definition of clear-cut activity loci and the presence of a single hearth indicate that the camp was the product of a single occupation rather than a sequence of several closely-spaced uses.

The recovered debitage sample indicates that a full range of lithic manufacturing and maintenance tasks were undertaken at the site, but the predominance of tertiary flakes and the high tool-to-debitage ratio demonstrate an emphasis on maintenance and rejuvenation of existing tools. Tool manufacture appears to be a secondary activity associated with the casual exploitation of the medium grade porcellanite outcrop at the site. This reflects the pattern of casual lithic raw material procurement characteristic of this region. The low debitage density, low tool density, and high tool-to-debitage ratio are all similar to other transitory encampments and indicate that occupation at One Bear was short-term. This is consistent with the well-defined activity loci and the absence of evidence for extensive reuse of the hearth. Although it is not possible to determine the exact duration of this occupation, it is interesting to note that the distribution and density of materials at One Bear resemble those noted at short-term !Kung Bushmen camps utilized for periods ranging from 3 to 15 days (Yellen 1977a, 1977b).

Representatives of 11 different tool classes were found at One Bear (Fig. 34), but more than 90 percent of the tools are basic cutting and scraping implements. Coupled with the low number of projectile points, this indicates that the procurement and processing of small game and vegetable foods were the primary economic activities at the site. This is consistent with the small recovered bone sample that represents rodents and small game animals, and the hearth characteristics that suggest it may have been used as a root roasting pit. The presence of several special purpose tools, however (e.g., burin, drill, notched pieces), also indicates that some secondary manufacturing activities were conducted at the site. This inference is strengthened by the

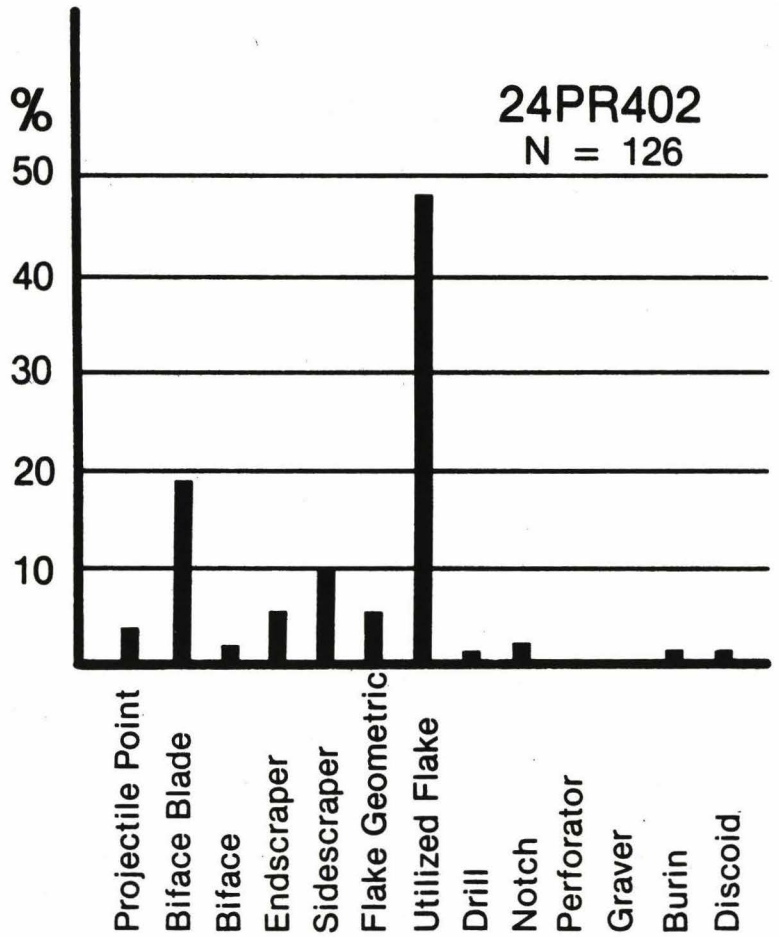

Fig. 34. Tool classes from the One Bear site, surface and subsurface specimens combined.

clustering of these tools with several scrapers in a single activity locus representing a work area.

Thus, given the varied tool assemblage, coupled with the evidence for hunting, butchering, cooking, and probably plant food collecting and preparation, it seems likely that the group living at One Bear was a residence unit composed of males, females, and probably children. Support for this inference is provided by the segregation of functionally distinct, synchronic activity loci whose component artifacts suggest task groups with different compositions.

Demographics

The density, size, and patterning of the living area at One Bear enable some tentative estimates of group structure and size. The arrangement and obvious interrelationships of the activity loci defined by our density distribution analysis suggest that they result from the activities of a single residence unit. This inference is strengthened by the occurrence of only a single hearth since ethnoarchaeological observation (e.g., Yellen 1977a:91-103; Gould 1980:6-10) has shown that family groups each tend to maintain a separate hearth.

Furthermore, the three defined artifact clusters appear to represent a generalized residential area and two specialized activity areas. The hearth area (cluster A) apparently represents a processing, cooking, and consumption area, but not a sleeping or general work area. The debris scatter surrounds the hearth, and relatively large quantities of sharp, angular bone chips and lithic debris occur there. These artifacts are exactly the sort that occur in the "drop" zone of a primary activity area (Binford 1978) but which would not likely be deposited or left in a sleeping area or structure. Additional support for this

interpretation is provided by ethnoarchaeological observations showing that hearths within structures or living areas tend not to be completely surrounded by debris, but instead to show a crescentic pattern of debris concentrated on two or three sides (Yellen 1977a; Binford 1978; Don Henry, personal communication 1981). Studies have shown that the "open" area remaining around such hearths reflects either an attempt to avoid the smoke, sparks, or ash carried to one side by the prevailing wind (Binford 1978; Don Henry, personal communication 1981) or the clearing of a sleeping space (Yellen 1977a, Binford 1978).

A combination of factors suggests that cluster C may represent a residential area. The activity area is characterized by the most diverse tool kit of the three clusters. Implements here reflect cutting, scraping, and various special purpose tasks. Coupled with the recovered bone debris, the tool kit suggests hide-working, woodworking, limited butchering, and food consumption. Despite the variety of activities, however, both tool density and debitage density are slightly lower here than in either other cluster, implying that activities conducted here were "finishing" or secondary manufacturing activities that required lighter duty tool use, hence less tool maintenance and rejuvenation. This tool kit and the inferred activities suggest a task group composed of both men and women utilizing space primarily important for multiple purposes. This suggests a generalized residential area, rather than a special purpose activity area such as the food preparation area at the hearth.

The overall pattern of debris and the presence of the "radiator" rockpile provide further support for our identification of cluster C as a residential area. The rockpile was apparently brought to its position

to serve as a heat radiator, presumably for warming a sleeping or work area. Furthermore, the debris comprising cluster C occurs in a crescentic pattern on the east side of the rockpile. Although much of the area west of the rockpile was not hand excavated, and thus exact debris densities are not known, no concentrations of material were observed when the topsoil was stripped during construction, and the density distribution in the hand excavated area shows relatively "open" areas to the south and northeast of the rockpile in a configuration one might expect if these areas were reserved for sleeping. Furthermore, the largest bone splinters are found at the periphery of the cluster, two or more meters from the rockpile. These probably represent "tossing," "dumping," or "sweeping" behavior (Binford 1978) designed to clean the central area for sitting or sleeping.

Finally, speculation as to whether or not part or all of cluster C represents a structure is probably beyond the scope of the recovered data, especially in light of Binford's (1978) recent illustrations that patterns like these need not necessarily represent the location of former dwellings. However, the utility of the radiator rockpile would probably have increased had it been inside some sort of structure.

Cluster B, like cluster A, appears to be a specialized activity locus where heavy-duty cutting activities predominated. High tool and debitage density, coupled with the high incidence of broken biface blade fragments, indicate an emphasis on heavy cutting tasks requiring extensive tool maintenance and rejuvenation. The relative scarcity of bone in the cluster suggests that butchering or other bone work was not the focus of these cutting tasks; hence, perishable items such as wood or hide were probably cut and sawed here.

The artifact density at One Bear suggests that the group occupying the site was small, but the number of people utilizing it is difficult to estimate. As stated earlier, the presence of a single hearth implies that a single residence unit was responsible for the site. No evidence was uncovered during construction monitoring to refute this, and the close association of the only recognizable activity loci implies that it was a small group. Wiessner (1974), utilizing data from !Kung Bushmen campsites, indicates that for very small groups population estimates can be made using a formula of just less than 6 m^2 of living area per person. She derives the living area of an open site by including "all of the space within a continuous border that encircles huts, and major concentrations of bone, charcoal, vegetable remains, and other debris" (Wiessner 1974:349). Although it was difficult to exactly calculate the "living area" at One Bear because parts of clusters B and C apparently extended outside our excavation unit, we used a circular border around the distribution extending more than two meters outside the excavated area to estimate the additional primary living/working area. This calculation resulted in a figure of 63.5 m^2 which translates to almost 11 persons utilizing Wiessner's (1974) model. Without the presence of a second sleeping area this appears to us to be too many people, but a second sleeping area (structure?) not associated with a dense debris cluster might well have gone unnoticed, especially outside the hand-excavated area. Such peripheral sleeping areas/structures are commonly located in ethnoarchaeological studies (Wiessner 1974; Bonnichsen 1973; Gould 1980). Regardless of whether or not this estimate of 11 persons is precisely the number of people using the site, it does support our inference that a small, extended family-sized group was responsible for producing the One Bear site.

The apparent small size of the group using the One Bear site, coupled with these peoples' material culture inventory, provides some further insight into the demographics of this Late Archaic period population. Ethnographic studies consistently show a minimum of approximately 25 persons per band (Wobst 1974:170; Lee and DeVore 1968:244). Apparently this represents the minimum population necessary to provide mates and maintain marriage alliances (Wobst 1974:157, 170; Williams 1974:27). Therefore, we assume that the group of fewer than 15 persons at One Bear probably did not constitute a full band. Instead, we suggest that it was more similar to a family band, or kin-clique group, like the basic Great Basin Shoshone social group (Steward 1938; Malouf 1968). For the Shoshone, the combination of limited and areally/seasonally unpredictable resources made these small family bands the optimal economic unit. Full bands were formed only when a few smaller groups coalesced in response to the occasional resource concentrations that necessitated communal effort. Such assemblies occurred at antelope drives, rabbit drives, and camas harvests and it was at these times that social and religious institutions provided the integrative mechanisms to maintain these family bands as viable units. With this social system the Shoshone exploited the Great Basin (Steward 1938; Thomas 1973) and much of the northern Rocky Mountain region (centered around present day Yellowstone Park) during Late Prehistoric and early Historic times (Davis 1976, 1981; Malouf 1968).

An archaeological example of a similar social system involving the seasonal dispersal and coalescence of family-band sized units has been inferred for the Late Prehistoric period groups inhabiting part of the Cross Timbers transition zone between the Southern Plains and Ozark Plateau Woodlands in northeastern Oklahoma (Henry et al. 1979:235-236).

Although a single site is obviously an insufficient basis from which to infer an entire system, the data from One Bear, when coupled with those collected from a few other Pine Parklands area sites, do seem to form the skeletal framework of just such a system for the Late Archaic period in this area.

As indicated above, the One Bear site was apparently a short-term occupation utilized by a small family-sized group during the late spring or early summer. Predominant site activities were hunting and foraging for small game and vegetable food. Activities of lesser importance included minimal chipped stone tool manufacture and probably woodworking and hide-working.

A few sites similar to One Bear are known in this region. The nearest are Horse Shelter and Colt 45 Shelter, small rockshelters in the upper Armells Creek drainage approximately 100 km northwest of One Bear (Fredlund 1973:27-46). Both sites show evidence of intermittent winter and spring use by small groups of Late Archaic period hunters during the period from A.D. 1 to approximately A.D. 800 (Fredlund 1973:36-38, 61-63). Additionally, Horse Shelter produced three side-notched projectile points (Fredlund 1973:47-51) that appear to be small dart points similar to those recovered at One Bear. Although Fredlund provides no actual size estimates for the groups using these sites he gives the impression that the rockshelters were occupied by small family-sized groups (Fredlund 1973:67-70). This inference is supported by the small size of these shelters, each of which has a total floor area that, on the basis of Wiessner's (1974) formula, would have supported fewer than 15 people.

In contrast, Level III of the Kobold site appears to represent aggregation of several small groups of Late Archaic period hunters. The

site, a bison jump on Rosebud Creek approximately 90 km directly west of One Bear, contained a rich cultural assemblage indicating fall season communal bison procurement (Frison 1970a:31-32). Estimated dates for Kobold Level III are 1000 B.C. to A.D. 500 (Frison 1970a:32), but several of the recovered projectile points are very similar to those from One Bear, suggesting that the later estimate may be closer to the actual age. Elsewhere Frison (1970b:5-6, 1973:5, 79) has argued that communal bison procurement of the magnitude noted at Kobold would require relatively large groups of approximately 100 people living together for extended periods of two to five weeks. Thus, it seems likely that Late Archaic period groups in this area of the Pine Parklands did congregate into macro-band-sized groups of 50-100 people during the fall of some years.

In summary then, the combination of data from Kobold, One Bear, and the Armells Creek rockshelters tentatively suggests a social system based on the dispersal of small family bands that aggregated into larger units for special seasonal events such as fall communal bison procurement. We hope that further research in this area focuses on obtaining data bearing on this hypothesis.

The material culture of the One Bear site occupants provides some clues about their interaction sphere and the types of contacts they had with other groups. The data of A.D. 710±65 is very late for an Archaic technology relying on darts and atlatls. Elsewhere on the Northwestern Plains the bow and arrow had been introduced by approximately A.D. 200 and were in widespread use by this time (see Frison 1973:25, 1978:61, 69-72, 224-229; Reeves 1978; Kehoe 1973:43-78). Based on the much

greater versatility and efficiency of the bow and arrow over atlatl and dart, Frison (1978:223-224) has argued that the bow and arrow were rapidly adopted by groups to whom they were introduced. Support for this interpretation is provided by the paucity of projectile point forms intermediate between arrow and dart points, and the rarity of single component assemblages including both dart and arrow points. Hence, given the apparent rapidity of adoption of the bow and arrow, its absence at One Bear strongly suggests a conservative population who had limited contacts with bow-and-arrow-using groups elsewhere on the Northwestern Plains.

Further support for the inference of conservatism and a restricted interaction sphere is provided by the ratio of lithic raw material types recovered from One Bear. More than 80 percent of the utilized lithics are porcellanite and fused glass available locally in the Tongue River uplands. Additionally, much of the chert and quartzite was obtained from river gravel deposits, probably those along the nearby Tongue and Powder Rivers. This extreme reliance on locally obtainable lithic resources is in marked contrast to the Highwalker site, and indicates a very localized interaction sphere. Utilizing Syms' (1977:5-8) coinfluence sphere model, we suggest that the Tongue River uplands region was the homeland of this Late Archaic period group. Furthermore, it appears that they did not have expansive areas of secondary and tertiary utilization.

Summary

One Bear is a small, Late Archaic period occupation site in the Taylor Creek drainage of southeastern Montana. The site is located on a restricted, canyon-bottom terrace above Yonkee Spring. The site location,

near the head of a deep, narrow, heavily forested canyon that enters the Taylor Creek floodplain from the north, is optimally situated for exploiting the surrounding pine parkland uplands and the adjacent floodplain ecosystems.

Chipped stone tools were recovered from a single occupation level, shallowly buried in the thin terrace soil. The tools and features at the site indicate a single occupation by a small group of Late Archaic period foragers. Small, side-notched dart points from the site and a radiocarbon date of A.D. 710±65 on the single hearth place the occupation at the terminus of the Late Archaic period.

Artifacts from the site, coupled with their intrasite patterning, indicate that a small, family-sized group (probably consisting of fewer than a dozen persons) used the terrace location as a short-term campsite. During the occupation the group's efforts were focused on hunting small game, capturing rodents, and probably gathering plant food. They also minimally exploited the local porcellanite source for lithic raw material, and did some limited manufacturing such as chipped stone tool making, woodworking, and hide-working. However, the low tool density and high tool-to-debitage ratio indicate that these manufacturing activities were of secondary importance to the primary food procurement tasks and the maintenance of existing tool kits. The season of occupation cannot be definitely determined, but the setting and resources exploited tentatively suggest a spring season campsite. Likewise, duration of the occupation is not certain, but the distribution and density of debris are comparable to the remains characteristic of modern foragers' campsites used less than two weeks.

The group living at One Bear was smaller than a band. Quite probably it was a kin-clique group, similar to the basic Great Basin Shoshonean social group. Most of the year this small group was probably self-sufficient as it exploited the Tongue River uplands, but occasionally, due to resource conditions that necessitated a larger work force than the group could muster, it merged with other local groups to conduct communal activities. One such situation was communal bison killing, but others probably also occurred. At these times religious ceremonies and social activities would have been conducted to maintain group stability and societal integration.

Given this social system and settlement pattern, the people who lived at One Bear (and probably most of their regional contemporaries) were relatively conservative folk who had little contact with outsiders. Because their system was attuned to the resources found in the Tongue River region of the pine parklands, minimal contact with groups outside their homeland was necessary. Whether their restricted interaction sphere is a cause or an effect of their conservatism is not known, but it is apparent that they had resisted the "modernizing" effects of widespread technological innovations such as the bow and arrow and pottery for several hundred years. Their system did not last much longer, however, for in less than 300 years this area was inhabited by groups using bows and arrows and ceramics who participated in a regional exchange system that reached from the Missouri River to the Rocky Mountains.

NOTES

[1] The letter-number designations in these sections refer to column and row coordinates that can be used to pinpoint specific one meter squares on the excavation unit plan maps.

[2] For purposes of this analysis cluster boundaries are defined by a line enclosing the shaded (high-density) area on the density distribution map. Also included within the cluster are unshaded quadrants surrounded on three or four sides by shaded quadrants. Tools were assigned to a particular cluster on the basis of the maximum cluster boundary encompassing both bone and debitage distributions.

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